THE FRANK GASPARRO PAPERS

BOX XVIII

American Numismatic
Association
Frank Gasparro Papers

Mint Plans
Mint Papers

Gasparro Papers
Box 18

Mint Plans

TRANSFER ENGRAVING

Procedure for making Galvanos

The Sculptor-Engraver submits to the Transfer-Engraver a model of his work. This is modeled in plastalene (modeling clay) on a lay-out board. A metal band is placed around the model, encasing it in a desired diameter. The band is secured to the lay-out board by placing plastalene around the inner and outer bottom edge. Then ice-cold water is poured into the encased area. Make sure there is no leakage. After a chilling period of one-half hour, remove the water.

Prior to pouring water, an application of separator is applied to the model and surrounding area by brushing ever so gently, so as not to disturb the detail of the model.

After water is removed, it is then ready for plaster. Mix plaster accordingly as to the amount and texture desired. Pour into the encased area and shake (vibrate) vigorously for a few moments. This will enable the air bubbles to rise to the surface. Let set and harden. Check periodically, and when plaster is very warm, remove metal band. After it cools, it is ready to separate. Remove cast from the model, inspect and return to the Sculptor-Engraver. After he inspects the cast for any flaws, and if the case may be, he will repair same. He then returns the plaster cast, so that a positive cast be made from the first one.

AFTER #2

LACQUER AND THINNER CAN BE PROCURED FROM SHERWIN-WILLIAMS CO. U.S.A.

AFTER #4

USE SEPARATOR OR KEROSENE (70%) MIXED WITH BEES WAX (30%)

AFTER #10

TANK - 24' X 36" X 22"

COPPER SULPHATE SOLUTION

BUSS BARS -

BAR HOLDING PLASTER ATTACHED BY NEGATIVE WIRE.

BAR HOLDING ANODES ATTACHED BY POSITIVE WIRE.

ELECTROPLATE CONTROL PANEL

VOLTAGE - 4 VOLTS - 30 AMPS

When making a cast from another cast the following steps are taken:

1. Make sure cast is thoroughly dry.
2. Using a mixture of Lacquer & Lacquer thinner, pour over cast making sure entire area is saturated. This acts as a sealer. Let it set and solution will evaporate.
3. Place cast on lay-out board and secure a metal band around diameter of cast. Use plastalene around inside surface of band to seal and fill in irregular openings. Make sure there is no visual openings.
4. Brush on the separator, evenly and smoothly, making sure there is no coagulation of separator. Brush off excess. Separator consists of bee's wax and kerosene.
5. Prepare plaster of paris for pouring. Place desired amount of water in a mixing container. Pour in plaster by spooning, until it just about covers the water level, then stir first by spoon and finally by hand. Make certain there are no lumps of plaster. When texture is correct, pour into the encased cast. Vibrate to bring air bubbles to the surface. Let it set and harden. When cast is ready for removal, use a thin blade between the seams of the cast. Tap gently and this will release the work. Remove top cast and return both to the Sculptor-Engraver.
6. After final inspection by the Sculptor-Engraver, the cast is returned for processing.

The following steps are taken for producing galvanos:

1. Make sure cast is thoroughly dry and free from any sealers.
2. Score a groove completely around diameter of cast. This is to accept two strands of wire for hanging purposes.
3. Place in heated kiln for one-half hour at 90°-100° C.
4. Place in melted bee's wax and make certain it is under wax level at least 1/2".
5. Let cast remain in bee's wax for two hours.
6. Remove from wax and brush away wax. Brush away excess wax making certain there is no build-up of wax.
7. Place on two sticks on work table. Commence to brush on Electro-Copper powder. Start from the outside diameter, outer surface, and work into center.
8. Remove to cool area and let stand to cool.
9. Place two copper wires around grooved diameter and secure to hangers.
10. Blow off excess copper powder and place into plating tank. Use about three volts. The work should remain in the tank for at least five days. This will give a very good deposit of copper.
11. Remove from tank and rinse with clear water. Hang and let dry for a day.
12. Remove wire hangers and band saw around diameter excess. Then place over gas flame the copper surface. This will loosen the galvano from the plaster cast. Remove the galvano from the cast and clean the finished surface.

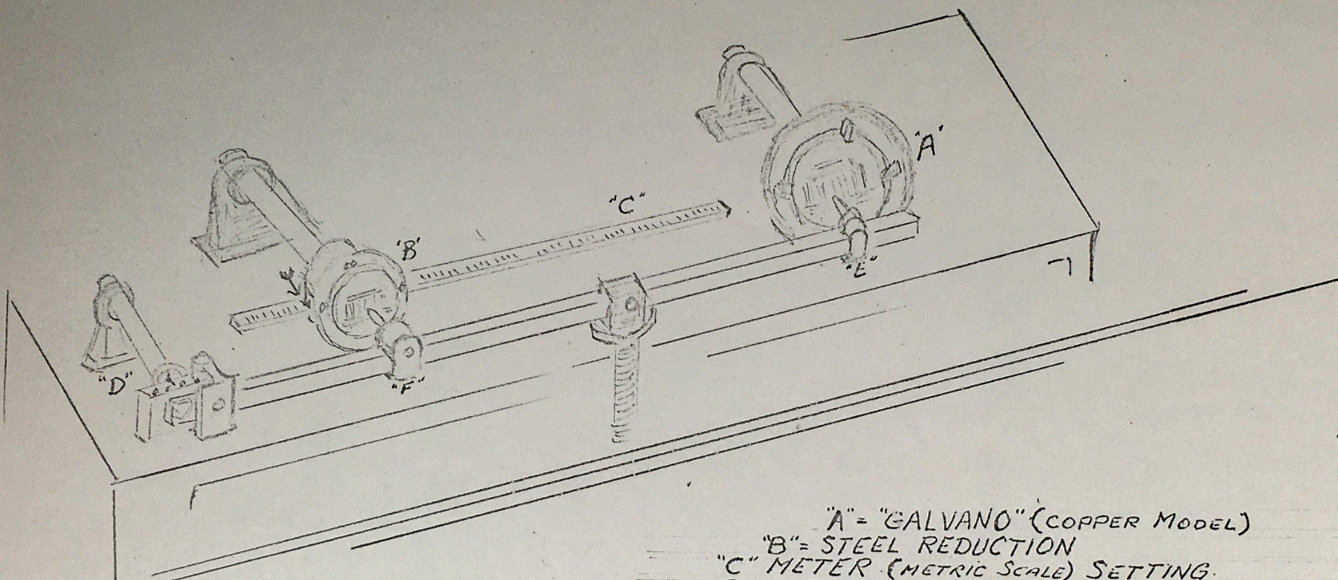
When cleaning, use kerosene and wire brush. Then rinse and finish cleaning with strong detergent and rinse in clear water. Dry and return to Sculptor-Engraver.

13. The Sculptor-Engraver will final inspect the Galvano.
14. The Galvano is returned to the Transfer-Engraver for backing-up.
15. The Galvano is placed "detail" side down on a lay-out board. A band is secured around the diameter. Plastalene is again used for sealing the irregular edge. Plaster is mixed and poured into the encased Galvano. When plaster is set, remove the band and let dry. Galvano is now backed-up and ready for mounting on face plate.
16. When Galvano is mounted on face plate of reducing machine, be certain that it is level and concentric. This is very important, especially when making a die.

-oOo-

ONE CENT REVERSE

GALVANO SIZE = 7.305" (ID) — 185.5 MM.
HUB SIZE = .698" (ID) - 17.7 MM.
RATIO = 10.4 ÷ 1



"A" = "GALVANO" (COPPER MODEL)
"B" = STEEL REDUCTION
"C" METER (METRIC SCALE) SETTING.
"D" RELIEF ARM (SETTING FOR DESIRED RELIEFS)
"E" = TRACER., "F" = CUTTER.,

GALVANO (MODEL) IS SET AT A FIXED POSITION. THE STEEL REDUCTION IS MOVED TO THE DESIRED POSITION ON THE METRIC SCALE. THE RELIEF ARM IS ADJUSTED TO GIVE THE DESIRED HEIGHT OF RELIEF. THE MODEL AND REDUCTION ARE CENTERED IN RESPECT TO ONE ANOTHER. THE TRACER IS STATIONARY AND THE CUTTER REVOLVES AT A HIGH SPEED WHILE CUTTING.

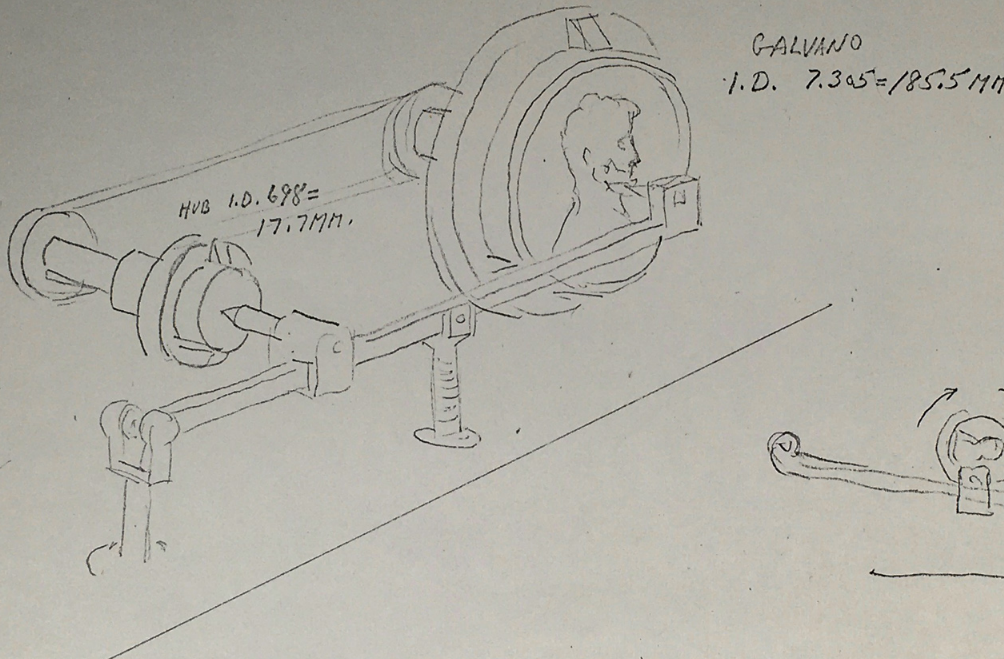
EXAMPLE.

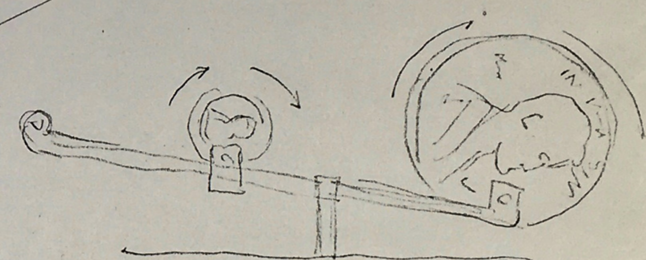
GALV. SIZE "A" = 7.305" (ID) = 185.5 MM. = MACHINE SETTING = "C" SCALE READING (MM.)
HUB SIZE "B" .698" (ID) = 17.7 MM. RELIEF ARM "D", SETTING FROM CENTER OF ARM TO DESIRED PIVOT.
RATIO = $\frac{10.4}{1}$

ONE CENT REVERSE

RATIO $\frac{10.4}{1}$

#1120 MACHINE SETTING = 107.1 MM.





I.D. GALVANO 185.5 MM.

I.D. HUB. .698 – 17.7 MM

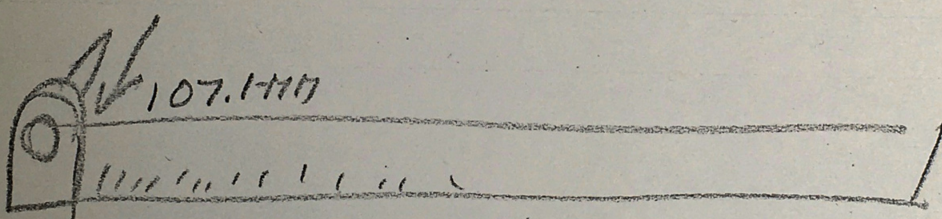
1120. MACHINE MM.

× 17.7 MM

19870.0

GALVANO 107.1 MM. Avg.

185.5) 19870.



17. The Transfer Engraving Machine is now readied for making a reduction. The Transfer Engraving is informed as to what size to make the reduction. From this information he arrives at a setting for the machine. This is done by either triangulation or by use of a formula. The proper ratio is established and the stylus or tracer, and the cutter is ground and honed accordingly. The "Galvano Model" is then placed on the Machine and the steel is placed in its receptacle also. Both of these members must be concentric and parellel to each other. This makes it possible to eliminate any exaggerated error.

The relief is also designated by the Sculptor-Engraver and the relief arm of the machine is then set to its desired setting. This will establish the height of relief. After the final cut is taken, the work is measured and its detail is inspected very closely. Accuracy and quality is very important. This procedure is for Master Dies, Hubs, etc., etc. Both negative and positive wax enlargements are also cut on the Transfer Engraving Machine.

The Mechanical Features of the machine enables the arm to move from a horizontal (leveled) position to a downward position. The tracer is stationary, and the cutter revolves at a speed of approximately 3500 RPM. Both the model, and the steel being cut, revolve at a slow speed simultaneously. The tracer will "pick-up" every minute detail, and in turn the cutter reproduces it in the steel. Below is an example of how the machine setting is determined:

"The New Lincoln One Cent Reverse"

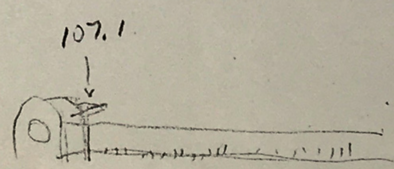
Galvano Size = 7.305" (I.D.) = 185.5 mm
Hub " = .698" (I.D.) - 17.7 mm
Ratio = $\frac{10.4}{1}$ This is the ratio of the Hub to the pattern.

#1120 Machine Setting = 107.1 mm

1. Multiply Hub Size x Machine Size = 1120 m.m.
   17.7 m.m.
   =19870.0

2. Divide product of Step "1 by Galvano Size = $185.5\overline{)19870.00}$ 1071

The Sum 107.1 is the setting for the Transfer Engraving Machine pivot arm.



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AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION, (MINT PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	A - <u>PACKING EQUIPMENT</u>				
1.	Packing paper for Mint Proof Coins 1 MIL Mylar or equal with 1/10 MIL Polymer coating plus 1/½ MIL Polyethylene extruded in coils of 3" breadth	Standard Packing Corp. 1 Lisbon Street Clifton, New Jersey	1900 lbs.	$1.10 per lb.	$2090.00
2.	2 semi-automatic sealing machines each should be delivered with a die conforming with the set of current coins and the other die conforming with the set of commemorative high dam set.	Mercury Packaging Machinery Corp. 2601 No. Howard Street Philadelphia, Pa. Hercules Products Inc. 12th & Brown Streets Philadelphia, Pa. PO 5-2975 PO 5-2933	2	$1500.00 each	$3000.00
3.	4 foot operated sealing machine sealing bar size about 8" x 1/4" - 220 V. - A. C. - 50 N	William B. Sanford Inc. 115 No. Brookfield Road Cherry Hill, New Jersey	4	$175.00	$700.00
	B - <u>MATERIALS FOR DIE PRODUCTION</u>				
1.	<u>Motor Set for Proof Polishing Dies</u>				
	a. <u>Dumore Power Flex</u> Catalog No. 6-012 Serial No. 8145-1056 220 V. 2 amps A.C. 0 to 50 cycles cont. 40°C rise no load R.P.M. 20,000	Dumore Company Racine, Wisconsin	2 pcs.	$125.00 each	$250.00
	b. <u>Foot Rheostat</u> No. 2-246 220 V. for variable speeds	"	2 pcs.	$50.00 each	$100.00

AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION, (MINT PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	B - MATERIALS FOR DIE PRODUCTION (Continued)				
	c. Hand pieces for above with collets and attachment to hold arbors of 1/8" - 1/4"	Dumore Company Racine, Wisconsin	2 pcs.	$65.00 each	$130.00
2.	Arbors				
	a. Arbor R-406-0031	Dumore Company Racine, Wisconsin	100 pcs.	$.20 ea.	$20.00
	b. Arbor 3/32" diam. for felt disc	William S. Waples 115 So. 8th Street Philadelphia, 6, Pa.	2 doz.	$.20 ea.	$4.80
3.	Elgin Cartridge Diamond Compound	Elgin National Watch Co. 107 National Street Elgin, Illinois			
	a. 18 gram tube No. 9 medium green 6-12 mesh These tubes should be delivered accompanied with one cartridge holder pump.		10 tubes	$99.00 per tube	$990.00
	b. 18 gram No. 3 medium yellow 1-5 mesh These tubes should be delivered accompanied with one cartridge holder pump.	" " "	4 tubes	$66.00 per tube	$264.00
4.	Emery Polishing Paper				
	a. 3M 2/0 paper grit	3M Minnesota Mining and Manufacturing Co. St. Paul, Minn.	1000 sheets	$.10 per sheet	$100.00
	b. 3M wet or dry TRI-M-ITE paper grit 320A	" " "	1000 sheets	$.10 per sheet	$100.00
	c. Polishing paper for Proof Coin Dies 4/0 paper	Behr Manning Division Norton Company 4732 Stenton Avenue Philadelphia, Pa.	200 sheets	$.20 per sheet	$40.00

[illegible] AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION (Illegible) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	B. MATERIALS FOR DIE PRODUCTION (Continued)				
5.	Mexican Hair Felt Sheets of 5/8" thickness of approximate 1" x 1½"	Quaker City Felt Company 1734-36 Ludlow Street Philadelphia 3, Pa.	10 lbs.	$4.55	$45.50
6.	Hole Saw Hole saw No. 505 - hole size 1-1/8"	Misener Manufacturing Company, Inc. Syracuse, New York	1 pc.	$20.00 per pc.	$20.00
7.	Poplar wood - lumber yard - of 1/2" thickness	Ideal Lumber Company 479 No. 4th Street Philadelphia, Pa.	4 cu. ft.		
8.	Brass Brushes No. 13-460	William S. Waples 115 So. 8th Street Philadelphia, Pa.	4	$1.75 ea.	$7.00
9.	Solid Felt Wheel Buffs #14-712 - 1½" dia. 1/4" thick	" " "	10 doz.	$.25 ea.	$30.00
10.	Burnishers Straight Blade #15-001½" with 1½" blade	" " "	4	$1.00 ea.	$4.00
11.	Victor Engraving Block #21-201 complete with attachments and leather pad	" " "	1	$71.25 each	$71.25
12.	Pocket Coddington Magnifiers #22-020½ focus 20X	" " "	10	$8.00 ea.	$80.00
13.	Engravers Glass Magnifiers #22-297 lens dia. 1-5/8" power 3.5X	" " "	4	$4.25 ea.	$17.00

AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION, (HALF PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	B – MATERIALS FOR DIE PRODUCTION (Continued)	William S. Waples 115 So. 8th Street Philadelphia, Pa.			
14.	Arkansas Bench Stone				
	#44-505 length 5", width 1-7/8"	" " "	2	$8.75 ea.	$17.50
15.	Hard Arkansas Slip				
	a. Triangular 3½" x 1/4" No. 44-593	" " "	12	$1.40 ea.	$16.80
	b. Square 3½" x 1/4" No. 44-583	" " "	12	$1.40 ea.	$16.80
16.	Arkansas Pencil				
	#44-549 length 7"	" " "	12	$2.40 ea.	$28.80
17.	India Triangular Slips				
	#44-693 4" x 1/4"	" " "	6	$.95 ea.	$5.70
	Square slips No. 44-683 4" x 1/4"	" " "	6	$.75 ea.	$4.50
18.	India Pencils				
	#44-649	" " "	6	$1.35 ea.	$8.10
19.	Scotch Stones				
	a. No. 44-822 1/4" square	" " "	4 doz.	$.30 ea.	$14.40
	b. No. 44-820 1/8" square	" " "	5 doz.	$.25 ea.	$15.00
	Clip-On Binocular For Engraver				
	Binocular 3X lens adapter +3 diop Total power 4-3/4 X approx. local range 6½"	By Telesito U. S. A. The Telescope Loupe	2 pcs.	$35.00 ea.	$70.00

AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION, (MINT PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	C – EQUIPMENT FOR FOUNDRY AND PRODUCTION				
1.	Foundry				
	– Graphite rods for deoxidizing 2" diam. electrodes, Acheson graphite grade A6, 2" x 24"	National Carbon Company Div. of Union Carbide 270 Park Avenue New York, N. Y.	10 doz.	$2.84 ea.	$340.80
	– Becker Synthetic Graphite between 1/2" and 1½" mesh	Becker Brothers Graphite Cicero, Illinois	2000 lbs.	$19.25 per 100 lbs.	$385.00
	– Pyrometer for control and measurement of temperatures ranging from about 800°C to 1500°C	Leeds & Northrup Company Fort Washington Industrial Park Fort Washington, Pa. Honeywell General Sales and offices 3345 W. Hunting Park Ave. Philadelphia, Pa.	3 pcs.	$250.00 per pc.	$750.00
	– P-CU phosphorous copper 15% deoxidizer	Ajax Metal Division of H. Kramer and Company Frankford Avenue and Richmond Streets Philadelphia, Pa. 19123 (215) REgent 9-1490 – – – – – Metallurgical Products Co. 35th and Moore Streets Philadelphia, Pa. 19145	5 Kg.	$1.50 per Kg.	$75.00
2.	Washing and Burnishing	Oakite Products 42 So. 15th Street Philadelphia, Pa.			
	Oakite 3 or 103		1/4 ton	$2.29 lb.	$1280.00
	Cream of Tartar	American Tartar Corp. 420 Lexington Avenue New York, N. Y. 10017	1/2 ton	$.30 lb.	$330.00
	Soap Bark (powdered)	S. B. Penick and Company 103 Church Street New York, N. Y. 10008	1/4 ton	$.42 lb.	$231.00

AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION (HALF PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	C - EQUIPMENT FOR FOUNDRY AND PRODUCTION (Cont.)				
	2. Washing and Burnishing (Continued)				
	Burnishing Media ball cones 1/4"	De Burr Company, Inc. 808 West York Street Philadelphia, Pa.	1 ton	$1100.00 per ton	$1100.00
	3. Production of Coins				
	- Cotton gloves	Albert W. Pendergast 6913 Tulip Street Philadelphia, Pa. 19135	100 doz.	$2.25 per doz.	$225.00
	- Diamond Tweezers No. 47-516 medium points of about 7" length		2 doz.	$1.50 ea.	$36.00

Mr. Gasparro w/manual
Engel
Leone
Wolf

7/26/68
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RECEIVED
JUL 26 9 12 AM '68

OFFICE OF
DIRECTOR OF THE MINT

TREASURY DEPARTMENT
WASHINGTON, D.C. 20220

July 25, 1968

Mr. Michael H. Sura
Superintendent
United States Mint
Philadelphia, Pennsylvania 19130

Dear Mr. Sura:

Several months ago, the State Department requested this office to assist in making available, through the United Nations, a candidate capable of offering technical assistance to the new Mint in Israel. It was stated that the facility houses a hydraulic press, stamping presses, and allied equipment. In the absence of more detailed information, it appears that the Israel Mint is capable of producing working dies and collars from master hubs produced elsewhere, and equipped to mint coins from blanks furnished by others.

Mr. Carl Borchert, Coin Production Supervisor, at the San Francisco Assay Office, has been selected for the assignment; he has been interviewed by the United Nations people, and it is expected that he will be requested to report in Israel early in September.

Since Mr. Borchert has had no experience in the production of working dies, we are assigning him for training under the tutelage of Mr. Gasparro, your Engraver, for one to two week's training. In addition to the production of working dies, he should be instructed by the Superintendent of the Mechanical Division in the making of collars, and by the Superintendent of Coining for any additional information he requires on press set-up, die setting, etc.

Mr. Borchert will report for duty at your Mint on Monday, August 5, 1968, at 9:00 a.m. I am sure that you will extend to him the full cooperation of your staff.

We enclose a copy of our letter dated July 25, to the Officer in Charge, U. S. Assay Office, San Francisco which is self-explanatory.

At the request of Mr. Gasparro by telephone to Mr. Neisser, we also enclose a copy of the restricted document entitled "Engraver's Manual - Gasparro & Macellaro - 1964", for use in updating this information with Mr. Borchert.

Sincerely,

S. F. Carmile
For Frederick W. Tate
Acting Director of the Mint

Enclosures

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RECEIVED
SUPERINTENDENT
U.S. MINT
PHILADELPHIA, PA.

JUL 26 9 12 AM '68

July 25, 1968

Mr. John R. Carr
Officer in Charge
United States Assay Office
155 Hermann Street
San Francisco, California 49102

Dear Mr. Carr:

This letter concerns the planned temporary assignment of Mr. Carl Borchert, Coin Production Supervisor of your institution, to provide technical assistance to the new Mint in Israel.

We enclose in duplicate, with one copy for Mr. Borchert, copies of the following:

Our letter dated July 25, 1962, to the Superintendent at Philadelphia concerning Mr. Borchert's temporary assignment for training in die making.

Travel authority for Mr. Borchert, covering his planned trip to the Philadelphia Mint.

We also enclose one copy of an official document, restricted for Mr. Borchert's official use only, entitled "Engraving Operational Manual - U. S. Mint Philadelphia - F. Gasparro and A. Macellaro - 1964".

Mr. Borchert shall, in the course of his training under the Engraver at Philadelphia, prepare an updated version thereof, containing additional detail process data to assist him later in meeting the requirements of his assignment.

Three copies shall be made; one for the official files of the Superintendent at Philadelphia, one for the Engraver, and one for submission to this office.

The official document or documents he carries with him are not to be shown to others; nor shall he reveal that he has such documents, and under no circumstances are any copies thereof to be made.

Upon completion of his training assignment at Philadelphia, Mr. Borchert is to return to work at your office, and to await further instructions concerning the trip to Israel.

Sincerely,

(S) Carwile

for Frederick W. Tate
Acting Director of the Mint

Enclosures
cc: Mr. Carl Borchert, Mr. Michael Sura, Mr. Frank Gasparro

PBN:mcw EBL SFC PJP

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for Frederick W. Tate
Acting Director of the Mint

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cc: Supt., U. S. Assay Office, S.F.
cc: Mr. Carl Borchert, U.S.A.O., S. F.
✓cc: Mr. Frank Gasparro, Engraver, Phila. Mint

PBN:mcw EBL SFC PJB

FRANK GASPARRO

F. Gasparro and
A. MACELLARO
1964
AUTHOR

[redacted]

THIS COPY FOR
FRANK GASPARRO

ENGRAVING OPERATIONAL
MANUAL
U.S. MINT PHILADELPHIA

This Document for
OFFICIAL USE ONLY

RESTRICTED

Per Philip B. Nessier
Tech. Consult.
Bur. of Mint Wash. D.C.

NO. photostat
or other copies
to be made

Sketch - - Usually a pencil drawing 3 to 5 times larger than the size of the intended piece. This is prepared by an artist, its purpose is to portray a fairly complete representation of the idea and appearance of the finished piece, composition, arrangement, style, type and size of lettering, purpose, dates, etc.

Model - - Using the sketch and or photographs a relief model is made in plastilene (modeling wax) several times larger than the intended piece, separate models are made for the obverse and reverse sides. These are built up on flat boards that have been shellaced, or on plaster discs that have been turned up to include a border and concave basin (field). These are also given a coat of shellac. At this time the height of relief is established keeping in mind the ratio of the model to the finished piece. Much of the lettering and finer detail is left out. It is more practical to do this in the negative.

Negative - Plaster The original sculptured model is surrounded by a band or 'fence' of stiff waxed paper or thin metal strip. This is fastened to the board or wrapped around the plaster disc and sealed with additional plastilene. A very thin film of olive oil or mineral oil is brushed over everything, including the inside of the band. Plaster of paris (gypsum) is mixed with water to the consistancy of thick cream and poured over the model, sufficient to completely cover the highest part of the design by a half inch or more. After the plaster has set, about 45 minutes, it can be lifted away from the plastilene and further work can be done with metal tools in this negative. Final detail and lettering can best be done at this stage.

Positive - Plaster All undercuts are carefully removed from the negative plaster and it is brushed with a coat of shellac or Opex (Sherwin Williams sanding filler), and after drying, a thin film of petrolatum or Dow Corning #7 compound (silicon lubricant) is applied. A flat band or strip is secured around the outer edge and a creamy plaster-water mix is poured

in to 1 inch or more thickness. Jiggling or vibrating the negative during this operation helps to prevent air bubbles. After the plaster has set, the band is removed and by carefully wedging with a knife blade and tapping gently, the two plasters will separate. Final cleaning up and finishing is done at this stage.

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GALVANO PROCESS

- These are copper replicas of the plaster model and are prepared by thoroughly drying the completed plaster model, either negative or positive, and immersing in very hot beeswax until all bubbling
2 ceases, then removing and when nearly cool, dusting with finely powdered copper, getting into all parts of the design and around the outer edge of the plaster. A copper wire is wrapped around this outer edge making contact with the powder. The dusted plaster is then suspended in a copper plating tank, with the wire attached to the
3. proper bus bar. Copper is plated from solution by electrolysis directly onto the design and plating is continued till a thickness of about 1/16th inch is deposited, - about 4 days. The plated plaster is then removed from the tank and the extreme outer edge is cut away on a band saw and the copper electrotype separated from the plaster. After cleaning up and backing with solder or asphalt, it is turned true (flat) on the back, and is ready for clamping to a face plate on the Janvier engraving-reducing machine. Those galvanos can also be given a decorative finish by plating or otherwise, and used for exhibit purposes.

EQUIPMENT.

QUAN. OF UNITS	NAME	SIZE	AREA CONSUMED
6	ELECTRO PLT. TANKS	21' - 9'	189 sq. ft for 6 units
1	DRILL PRESS	2'-6" x 2'	5 sq. ft
1	BAND SAW	3' x 3'	9 sq. ft
		TOTAL AREA	203 sq. ft

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JANVIER MACHINE

-- The principle purpose of the galvano is for use as a pattern on the Janvier machine. This machine traces over the design and reproduces all details in reduced size in a piece of annealed tool steel. A positive galvano is used to prepare a hub and a negative galvano for a die. A die cut directly on the machine can be turned to fit the press, hardened and used for striking medals or coins. Where a large run of coins or medals is contemplated, a hub (positive) is made, turned and hardened, and used as a punch or hob in an hydraulic press to form a number of dies. Final diameter is established at this time.

QUAN. OF MACH.	NAME	SIZE	AREA CONSUMED	H.P.
1	JANVIER	6'-6" x 3'-6"	23 sq ft	1/3
1	"	6' x 3'-6"	21 sq ft	1/2
1	"	4'-6" x 3'	13.5 sq ft	1/4
		TOTAL AREA	57.5 sq ft	

PREPARATION OF DIE BLANKS

Annealed tool steel bars, approximately 12 ft. long, are fed into a turret lathe. This machine cuts short lengths from the bar and also shapes one end of these short lengths into a cone. For U. S. coinage, the angles of cone, diameter and length used are shown on drawings included in separate folder. An analysis of the tool steel used is included in the specifications herewith. The rough blanks from the turret lathe are fastened in a 3 jaw chuck on an engine lathe and a leveling cut is taken across the flat end with a slight depression cut in the center for leveling. The cone on these blanks is then fine ground against a rotating steel disc faced with abrasive cloth #Carborundum Aloxite Type 3 320 x Resin Industrial Cloth. This is done by rotating the cone by hand in an adjustable fixture (for cone angle) against the revolving disc. This disc grinder consists of a 7½ H. P. motor mounted on a pedestal. A large 18" diameter steel disc is fastened to each end of the motor shaft. New abrasive cloth is cemented to these discs from time to time as it wears. The rotation speed is 1400 R. P. M.

After removal of lathe tool marks with the disc grinder, the cone is given a finer finish by hand lapping with progressively finer abrasive cloth Nos. 240, 280 and 400 fastened to a wooden lapping stick approximately 6" long x ½" wide x 3/16" thick and then buffing with a fine wire buff.

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EQUITMENT USED IN PREPARATION OF DIE BLANKS

QUAN.	NAME	SIZE	AREA CONSUMED	REMARKS
1	TURRET LATHE	21' x 5'-6"	115 sq ft	USED FOR #1 BLANKS & FOR BLISS PRESS
1	CONE AUTOMATIC MACHINE	20'-6" x 5'-6"	113 sq ft	USED FOR BLANKS (1A)(5)(10)(25)(50)
1	ENGINE LATHE	8' x 4'	32 sq ft	USED FOR LEVEL CUTTING OF BLANK
1	GRINDER (DISC)	5' x 2'	10 sq ft	GRINDING CONE PART OF BLANK
		TOTAL AREA.	270 sq ft.	

NOTE:

① One Man is used in this operation. See the following page for blank details.

② Bar Stock Rack for Cone automatic machine 11' long.

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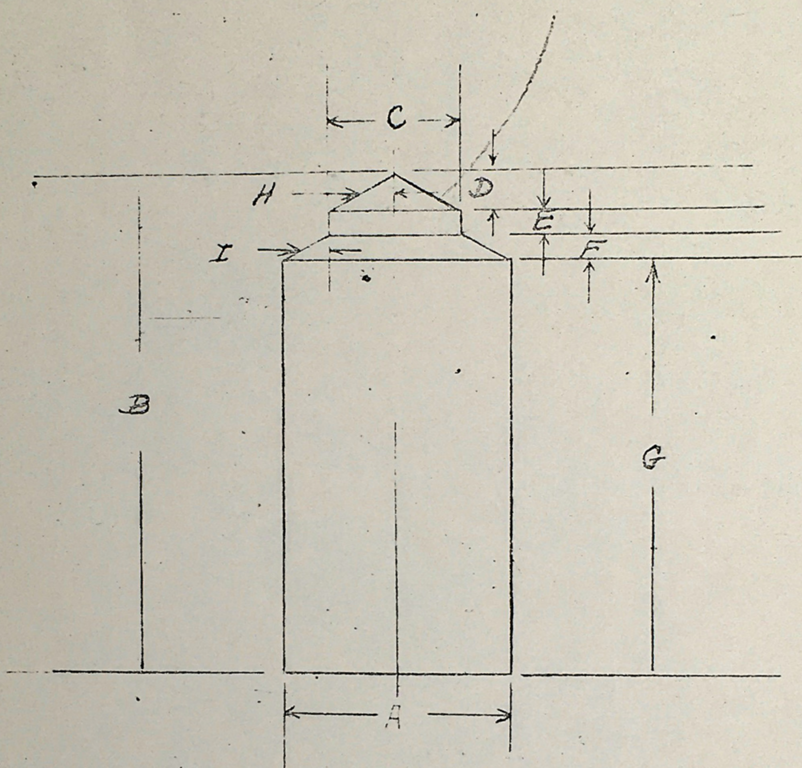
DIE BLANK DETAIL



SINGLE AND DUAL COINAGE BLANKS									
DENOMINATION	A	B	C	D	E	F	G	H	I
1¢ 5¢ AND 10¢ SINGLE OBV & REV	1.480	2 11/16	937	1/8	1/8	1/8"	2 5/16	20°	20°
1¢ 5¢ AND 10¢ DUAL OBV & REV	1.480	2 7/8	.937	1/8	1/8	1/8	2 1/2"	20°	20°
25¢ SINGLE OBV. & REV	1.480	2 11/16	1.125	9/32	1/8"	1/8"	2 5/32	20°	20°
25¢ SINGLE PROOF REVERSE	1.480	2 7/8	1.125	5/16	1/8	1/8	2 5/16	30°	30°
50¢ SINGLE OBV & REV.	1.605	2 13/16	1.240	3/16	1/8	1/8	2 3/4	25°	25°

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HOBBING OPERATION.

The finished coned blank is then ready for hobbing. This is accomplished by placing the blank and the hardened hub in a special fixture or subpress so that the inverted hub (face) is in alignment with the center of the cone on the upright blank. The fixture is adjustable so that different diameter blanks and hubs can be made to register center over center. The fixture with blank and hub is then centered on the anvils of a hydraulic press (capacity 700 tons) and pressure is applied, approximately 50 tons for 10¢, 60 tons for 1¢ and 5¢, 70 tons for 25¢ and 90 tons for 50¢. This forces the face of the hub against the cone on the annealed blank causing it to take a negative impression from the positive design on the hub.

One Hydraulic press (Watson Stillman) 700 ton capacity
One " " " " 800 ton "

Old Press Size is 5' x 8' = Area = 40 sq ft
New Press Size is 7'-6" x 6' = Area = 45 sq ft
Total Area = 95 sq ft

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ANNEALING OPERATION

The blank has now become work hardened and resists further movement. To relieve this condition the blank is annealed by packing in hardwood charcoal in nichrome cups and heating in an annealing furnace to 1425° F. soaking at this temperature for 4¼ to 4½ hours and then allowing to cool very slowly in the shutdown furnace, generally, overnight. The annealed die is now carefully cleaned with a dilute solution of Hydrochloric Acid (1 part acid to 3 parts water), hot water and thoroughly scrubbed with pumice soap. The hub is now carefully registered into the existing impression on the die and placed in the hydraulic press for a second blow (squeeze) using the same pressures as before. This procedure is repeated a third time for all U. S. coins except the half dollar which sometimes requires a fourth blow.

The die impression is now carefully examined to make sure complete, all over contact has been made with the design on the hub, that there are no doubles (failure to exactly register) and that it is clean with no foreign inclusions or impressions, scratches, etc.

	SIZE	AREA CONSUMED / FURNACE
Two Annealing Furnaces	10' x 6'-6"	65 sq. ft.

Turning Operation

The die is now fastened by the extreme lower end (base) in a 4 jaw chuck on an engine lathe and very carefully centered so that the inner edge of the border of the design runs true to center and the flat on the border runs 90° true to the axis. This is done by eye using magnification and a small pointer, accuracy to within .0001". After centering, the excess steel is turned off and the die is finished according to dimensions shown on submitted drawings in separate folder.

After turning the body of the die, it is placed in a 3 jaw chuck on an engine lathe with the base in position for cutting off to the specified length using gauges.

After turning, a different number is assigned to each die and this is stamped directly on the shoulder of the soft die and a record is kept of these numbers.

Dies prepared for single press operation are now ready for hardening. Dies being prepared for Phila. Mint dual operation are placed in a fixture on a milling machine and an accurate flat is milled into the base.

Dual dies for Denver are ready for hardening after turning to specified dimensions.

The small 'D' Mint mark is stamped, separately by hand, in the proper location on either the Obverse or Reverse of all U. S. coinage dies intended for the Denver Mint just prior to hardening.

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EQUIPMENT USED IN TURNING OPERATION

NAME	QUAN.	SIZE	AREA CONSUMED
LATHES	11	8' x 4'	32 sq ft/lathe
MILLING MACHINE	1	7' x 6'-6"	45.5 sq ft
(SURFACE) GRINDER	1	4'-9" x 8'	38 sq ft
"	1	5' x 5'-7"	28 sq ft
"	1	5' x 7'-6"	37.5 sq ft
"	1	5' x 7'	35 sq ft
		TOTAL AREA	216 sq ft.

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HARDENING OPERATION

The dies are hardened by again packing in hardwood charcoal in individual nichrome cups and placing in a hardening furnace. The temperature is brought up to 1475° and the dies are allowed to soak at this temperature about one hour per inch of die diameter.

The dies are then removed from the cups with tongs and placed face down in the correct hole in the quenching fixture. This consists of a large tank containing a pipe system and a nozzle 1¼" diameter pointing upward. This nozzle is oriented directly under a hole in the lid on the tank. Around this hole on the underside is a cylindrical baffle approximately 1½" deep x 3" in diameter to concentrate the water stream around the face and neck of the inverted die. An automatic device for mixing hot and cold water to a predetermined temperature and a quick opening valve are external parts of this quenching device.

At the instant the red hot die is inserted face down in the proper opening, the valve is opened manually and water preheated, from 70° to 76° F., under pressure, about 40 lbs. per square inch, is forced against the face of the die through the nozzle. To check the excess water from spraying around the clearance in the opening, an asbestos pad is held over the tongs and the base of the die. The die is held in this stream of water until it is cool enough to hold.

The dies are then cleaned on the face by scrubbing with a dilute solution of Hydrochloric Acid (1 part acid to 3 parts water) and pumice soap. The dies are then placed in a tempering furnace (Leeds & Northrup Homo) and kept at a constant temperature of 350° F. for 4½ hours except for 1¢ dies which are kept at 400° for 4½ hours.

They are then removed and tested for hardness and uniformity on a Rockwell Model 'TT' hardness tester, "C" Scale. Proper hardness has been established at between 59 and 61+ Rockwell "C".

Single dies for Phila. and dual dies for Denver are given a final close inspection for nicks, dents, pits, scale etc. and are then ready for setting in the coin presses or for shipment to Denver.

EQUIPMENT USED IN HARDENING OPERATION

FURNACE	TYPE	QUAN	SIZE	AREA CONSUMED
HEVI-DUTY	GAS FIRED	1	7'x8'	56 sq ft
SURFACE COMB.	GAS FIRED CHARCOAL	2	6'x7'-6"	90 sq ft
LEEDS & NORTH.	ELECTRIC FURNACE	1	6'-8"x8'lg	53 sq ft
TEMPERING FURNACE	GAS.	2	3' DIA.	14 sq ft
QUENCHING TANKS		2	3'-6" dia	

CONTROLS FOR FURNACES

	SIZE	AREA
CONTROLS FOR HEVI-DUTY FURNACE	4'-6"x 6'	27 sq ft
" " TEMPERING FURNACE	2'x 6'	12 sq ft
" PANEL	6'-3 X 3'	18.75 sq ft

MINIMUM REQUIREMENTS AND EQUIPMENT NECESSARY TO PRODUCE COIN DIES

Employees Required	Work Processes	Equipment
Artist-Engraver	1. To prepare drawing of completed and finished design for medal or coin.	
"	2. Scaled pattern prepared in wax or plaster (obv. & rev.) and ratio is formulated to size of coin or medal desired.	Plaster of paris.
"	3. Plaster negative prepared from this pattern. Letters are cut or incized in this negative side.	
"	4. Plaster positive prepared from this negative and retouched.	
Transfer-Engraver	5. Negative plaster then prepared to be used in forming positive galvano.	
"	6. This negative is bees waxed and copper-coated and is dropped into copper-plating tank from extended bars.	Bees wax, galvano tank, copper-plating solution - $2000.00
"	7. After four (4) days copper-coated galvano is taken out of tank. Galvano is trimmed.	Bridgeport Milling Mach. - $4400.00 Band-Saw - $1500.00
"	8. Galvano is backed-up and fitted on Janvier Machine plate.	Janvier Reducing Mach. - $12,000.00

Employees Required		Work Processes	Equipment
Transfer-Engraver	9.	Hub reduction produced or cut from pattern directly in steel.	Janvier Reducing Mach.
Die Maker	10.	Hub turned and hardened. Keys or lugs are slotted in this hub (for coinage) to prepare for dies.	Surface Combustion Heating Furnace - $9000.00 2000.00 $11000.00
Machine Operator	11.	Turret lathe prepares number of die coned blanks.	Turret lathe - $25,000.00 Conomatic - $51,000.00
"	12.	Finish cone base blank on Buck Chuck Engine Lathe.	Buck Chuck Engine Lathe 10" - Monarch $13,000.00
"	13.	Coned blank die finished or polished on disc-grinder.	18" pedestal disc-grinder - $1500.00
Die Maker	14.	Hub entered over die blank in fixture on hydraulic press.	Farrell type hydraulic press, 400-600 tons - $17,000.00
Heat Treater	15.	Die struck first blow placed in annealing.	Annealing Furnace - $10,000.00 Nichrome cups & pots - $800.00 + Charcoal mesh #1 & #2
"	16.	Die struck second blow.	
"	17.	Die turned on single four-jaw chuck, or by 1st & 2nd operation using Carboloid tips fitted in Aloris tool posts or by tracer lathes.	Monarch Tool-Maker Engine Lathe 10" - $13,000.00 Tracer Lathe - $13,000.00
"	18.	Die hardened and quenched.	Surface Combustion Furnace - Water-Quenching Tank $4000.00

Employees Required		Work Processes	Equipment
Heat Treater	19.	Die tempered to draw steel (water 70° to 75° F - 60 lb. pressure).	Homo-Tempering Furnace - \$7000.00
Die Maker	20.	Die ground to exact size.	Landis Universal Cylinder Tool Grinder - \$14,000.00 Surface Grinder - \$8000.00
"	21.	Die fitted in die set for coining press.	

SUPPLEMENTAL ISSUE TO OPERATIONAL MANUAL

Philadelphia, Pennsylvania
August 14, 1968

A recent Die Shop innovation permits a more controlled second strike or "blow" to the "blank" at re-entry of hub.

Six milled or ground spline grooves are formed at a 45° angle on the hub. After the first "blow" the formed "lugs" on the die blank are utilized as "locators" for an additional "blow".

These spline grooves are also ground in the lathe "drivers" to machine the various size die blanks required for the dual die system of operation.

Tracer controlled Engine Lathes with templates engineered to blueprint specifications are a valuable contribution to increased volume production of dies.

An operational sequence is as follows:

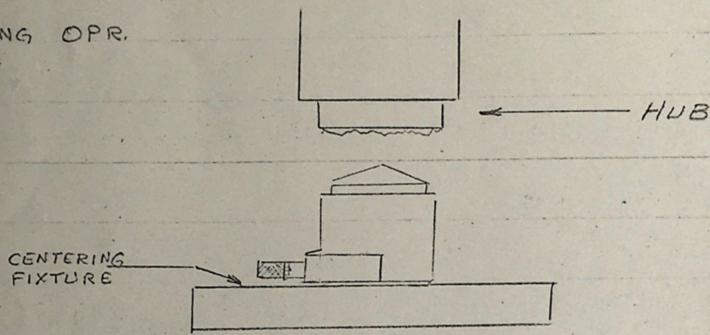
1. The polished die blank is struck by the hub at a given tonnage. The hub has a series of six spline grooves ground at a 45° angle to its face. This enables the re-entry of the hub for the final strike and also for being driven by the driver in the lathe.

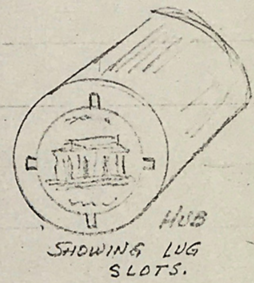
2. A driver with the desired lug slots is placed in the spindle of the lathe. The struck die blank is placed against the driver and the tailstock center is placed against the bottom of the die which has a center hole. The die is turned to a specified diameter. This is for construction purposes. This diameter is then placed in a collet. The machine (if it is a tracer lathe) is set with a template and the profiling operation begins.

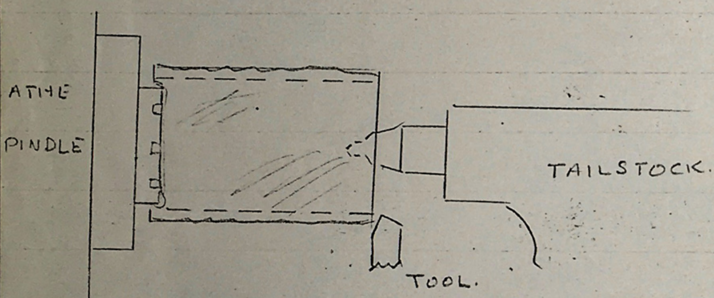
3. The turned die is then removed and placed in another lathe for cutting off the excess length to the desired size.

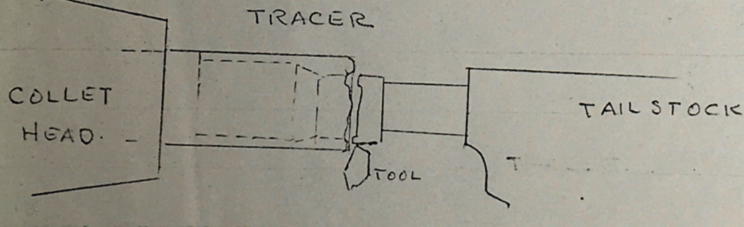
An engine lathe compound utilizes the CXA Aloris Tool Post with tri-edge carboloy tips. (Aloris Tool Co., Inc., Clifton, New Jersey.)

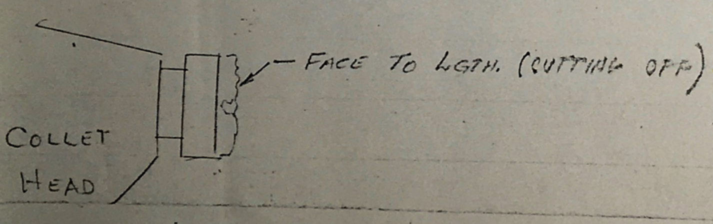
1ST STRIKING OPR.











A. B. Macellaro ABM

April 4, 1966

Analysis of Present Die Production
Capacity and Requirements for F.Y. 67

The detail data presented in this report was accumulated from the following sources:

(a.) Estimated coin production for the remaining fiscal year 66 and fiscal year 67, from Mr. S. Carwile.

(b.) Average coining die life, from reports sent to Bureau and discussions with Mr. D. Young.

(c.) Die production details, from Mr. F. Gasparro.

A. Accumulated Data:

1. Coining die production for F. Y. 66.

(a.) The estimated coin production for the remaining months of F.Y. 66, from March through June, inclusive, is 3,303,000.000 coins.

(b.) Dies required for estimated production, per denominations are as follows:

One Cent	-	1,328	dies
Five Cent	-	700	"
Dime Clad	-	20,181	"
Quarter Dollar (Clad)	-	12,868	"
Half Dollar (Silver)	-	5,618	"
Half Dollar (Silver Clad)	-	596	"
Approximate total of dies required	-	41,291	"

For estimated die production. - See Data Sheet #1.

2014000
13
3014000

2. Coining die production for F.Y. 67.

(a.) Estimated coin production is 13,008,000,000.

(b.) Dies required for estimated production per denominations are as follows:

One Cent	-	4,216 dies
Five Cent	-	4,332 "
Dime (Clad)	-	70,588 "
Quarter Dollard (Clad)	-	21,669 "
Half Dollar (Clad)	-	6,084 "
Approximate total dies required	-	106,889 "

For estimated die production. See Data sheet #2.

3. Coining die production for Special Mint Sets (F.Y.66).

(a.) Estimated Mint Set production 4,000,000.

(b.) Dies required for estimated production per denominations are as follows:

One Cent	-	160 dies
Five Cent	-	228 "
Dime (Clad)	-	532 "
Quarter Dollar (Clad)	-	532 "
Half Dollar (Clad)	-	132 "
Approximate total dies required	-	1,584 "

For estimated die production. See Data sheet #3.

4. Coining die production for Special Mint Sets (F.Y. 67).

   (a.) Estimated Mint Set production 8,000,000.

   (b.) Dies required for estimated production per denomination are as follows:

One Cent	-	320	dies
Five Cent	-	456	"
Dime (Clad)	-	1,064	"
Quarter Dollar (Clad)	-	1,064	"
Half Dollar (Clad)	-	264	"
Approximate total dies required	-	3,168	"

For estimated die production. See Data sheet #3.

5. Available equipment and manpower in engraving department (Die Shop).

   1. Seventy-five men. Twenty-five/shift.

   2. Equipment

      (a.) 18 conventional lathes

      (b.) 3 cylindrical grinders

      (c.) 2 surface grinders

      (d.) 7 hardening furnaces

      (e.) 4 annealing furnaces

      (f.) 1 conomatic lathe

      (g.) 1 turret lathe

      (h.) 2 hubbing presses

6. The maximum utilization of available equipment and capacity based on a production rate of 2,116 dies/wk. (1965)

The following results are based on a time study submitted by Mr. Gasparro. See sheet #4.

Operations	Die Prod. Rate/21 hr.	Die Prod./week
Conomatic	600	3,000
Disc Grind #1	600	3,000
Disc Grind #2	600	3,000
Hubbing #1	630	3,150
Annealing	600	3,000
Hubbing #2	600	3,000
Turning - 7 Lathes	441	2,205
Machining Base - 3 Lathes	756 duals	3,780
Inspection and Cleaning (2 men)	504	2,520
Die Hardening (7) Furnaces 25 Dies/furnace 175 Dies/3 hours (2 shifts) Quenching	700	3,500
Tempering (1) shift (4) Furnaces	560	2,800
Grinding Duals and Singles	252	1,260

7. Manpower required to produce 2,116 dies per week.

Operations		Total Manpower/3 shifts
1.	Conomatic	1
2.	Disc Grinding #1	1
3.	Disc Grinding #2	1
4.	Hubbing #1	6
5.	Annealing	6
6.	Hubbing #2	6
7.	Turning Lathes	21
8.	Base Machining	9
9.	Inspection and Cleaning	6
10.	Die Hardening	4 (2 shifts)
11.	Quenching	4 (2 shifts)
12.	Tempering	2 (1 shift)
13.	Grinding (Philadelphia only)	6
	Total	73 men

In view of the above results no additional manpower is required.

8. Estimated production increase, by DeVlieg method:

Method Operations	Estimated Time in Minutes
Center Drilling	1
Rough Turning	1½
Finish Turning	2½
Total time	5 minutes

In view of the above results, the DeVlieg operation will produce one die every 5 minutes.

Estimated die turning production for a 7 hour production/shift.

Operation	Dies/hr.	Dies/shift	Dies/3 shift	80% efficient Dies/week
Center Drilling	60	420	1,260	5,040
Rough Turning	40	280	840	3,840
Finish Turning	24	168	504	2,016

Based on the above results no additional equipment is needed with the exception of another turning lathe.

DIE PRODUCTION FOR F.Y. 66

DENOMINATIONS	PRODUCTION ESTIMATE FOR MARCH & JUNE	AVERAGE LIFE OF OBVERSE DIES. (STRIKES)	AVERAGE OBVERSE LIFE	AVERAGE LIFE OF REVERSE DIES (STRIKES)	AVERAGE REVERSE LIFE	AVERAGE LIFE OF REVERSE & OBVERSE DIES	TOTAL DIES REQUIRED
1¢	756×10^6	1,007,653 (P) 1,330,000 (D)	$1{,}168 \times 10^3$	1,044,207 (P) 1,173,752 (D)	1108×10^3	1,138,000	1328
5¢	97×10^6	319,000 (P) 216,000 (D)	267,000	324 000 (P) 251,000 (D)	287,540	277,000	700
CLAD 10¢	1.904×10^6	191,476 (P)	181,476	181,563 (P)	181,563	? 187,000	20,181
CLAD 25¢	978×10^6	178,000 (P) 134,144 (D)	156,072	176 000 (P) 121,000 (D)	148,500	152,286	12,868
CLAD 50¢	53×10^6	13 192,000 (D)	192,200	162,000 (D)	162,800	177,500	596
SILVER 50¢	15×10^6	626 361 62,656 (P) 339 344 ~~50,340~~ (D)	~~56,500~~	470,043 ~~47,043~~ (P) 473 824 53,536 (D)	50,289	~~53,394~~	~~5685~~
						APROX. TOTAL DIES	35,673

DIE PRODUCTION FOR F.Y. '67

DENOMINATIONS	COIN PRODUCTION ESTIMATE F.Y. 67	AVERAGE LIFE OF OBVERSE & REVERSE DIES (STRIKES)	TOTAL NO OF DIES REQ'D
1¢	2400×10^6	1,138,000	4,216
5¢	700×10^6	277,000	5054
10¢	6600×10^6	187,000	70,588
25¢	3300×10^6	152,286	21,669
50¢	108×10^6	177,500	6084
		APPROX. TOTAL DIES	107,611

SPECIAL MINT SET, DIE PRODUCTION F.Y. 66 & 67

ENOMINATIONS	PRODUCTION ESTIMATE FOR F.Y 66 MAR. TO JUNE	PRODUCTION ESTIMATE FOR F.Y 67	AVERAGE LIFE OF OBVERSE & REVERSE	TOTAL NO OF DIES REQ'D F.Y. 66	TOTAL NO OF DIES REQ'D F.Y. 6
1¢	4,000,000	8,000,000	50,000 STRIKES	160	320
5¢	"	"	35,000	228	456
10¢	"	"	15,000	532	1064
25¢	"	"	15,000	532	1064
50¢	"	"	60,000	132	264
			APPROX. TOTAL DIES	1584	3168

SHEET # 3

PRESENT DIE OPERATIONAL DATA

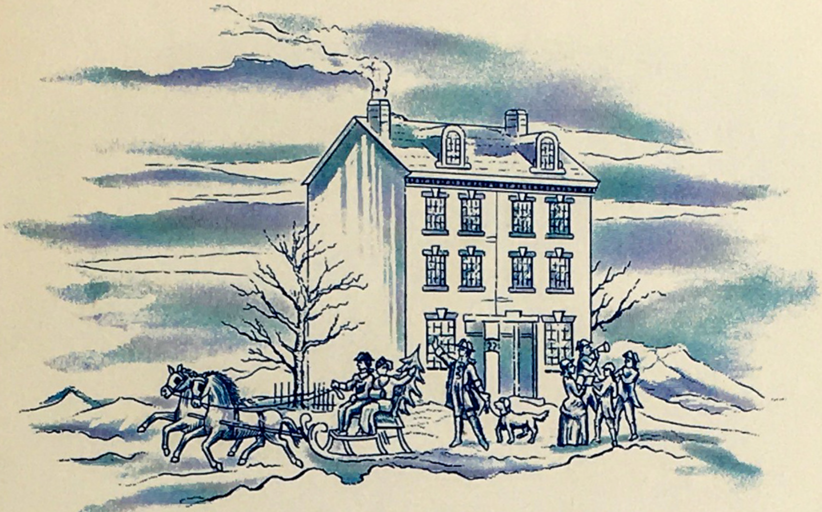
TIME STUDY.

OPERATIONS REQUIRED IN MANUFACTURING OF DIES	No. OF PIECES PRODUCED 24 HRS.	OPERATIONAL TIME IN (MINUTES) FOR SINGLE DIES		OPERATIONAL TIME IN MINUTES FOR DUAL DIES		
		25¢	50¢	1¢	5¢	10¢
CONOMATIC BLANKS	600	–	–	–	–	–
CLEANING.	600	–	–	–	–	–
GRINDING #1 CONE OF BLANK	600	2½				
GRINDING #2 CONE OF BLANK	600	2½				
HUBBING (FIRST BLOW)	270	4				
ANNEALING (AVERAGE)	270	3				
HUBBING. (SECOND BLOW)	270	4				
TURNING OPER. (BODY)	270	15	15	17		
MACHINING BASE OF DIE	270	5				
INSPECTION & CLEANING.	270	5				
HARDEN DIES (HEATING)	270	5				
QUENCHING	270	4				
TEMPERING	270	3				
GRINDING FLATS DUALS	45 DUALS	–	–	8 .10		
GRINDING BODY (DUALS)	45 DUALS	–	–	9 15		
FINAL INSPECTION	270	5				
TOTAL TIME REQ'D TO PRODUCE ONE DIE		56 MIN	56 MIN	76 MIN	76 MIN	76 MI

MINT PAPERS

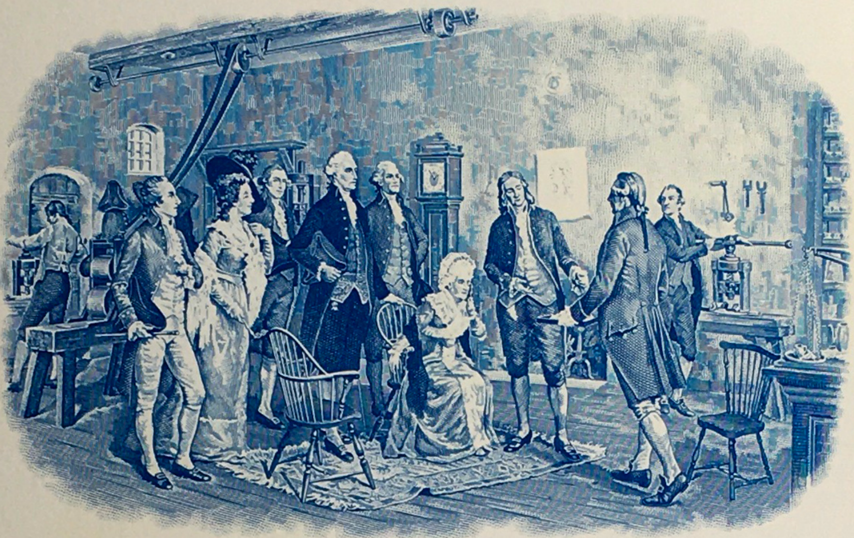
UNITED STATES MINT

INDEPENDENCE MALL
PHILADELPHIA



YE OLD MINT 1792

THE DEPARTMENT OF THE TREASURY



"INSPECTING THE FIRST COINS"


LIBERTY
1793
IN GOD WE TRUST
LIBERTY
1969

OFFICIAL OPENING CEREMONY
UNITED STATES MINT — PHILADELPHIA
INDEPENDENCE MALL
AUGUST 14, 1969
3:00 P.M.

☆

Prelude Music

THE 19TH U. S. ARMY BAND
FT. DIX, N. J.

☆

Presentation of Colors

U. S. MARINE CORPS RECRUITING STATION
PHILADELPHIA

☆

Master of Ceremonies

HONORABLE EUGENE T. ROSSIDES
ASSISTANT SECRETARY OF THE TREASURY

☆

Invocation

REVEREND C. JON WIDING
ASSISTANT PASTOR, CHRIST CHURCH
PHILADELPHIA

Welcoming Remarks

HONORABLE JAMES H. J. TATE
MAYOR, CITY OF PHILADELPHIA

☆

Introduction of Distinguished Guests

☆

Welcome to Foreign Mint Masters

HONORABLE EVA ADAMS
DIRECTOR, BUREAU OF THE MINT

☆

Response

HONORABLE ARNE BAKKEN
DIRECTOR, THE MINT OF NORWAY

☆

Address by

THE HONORABLE DAVID M. KENNEDY
SECRETARY OF THE TREASURY

☆

Benediction

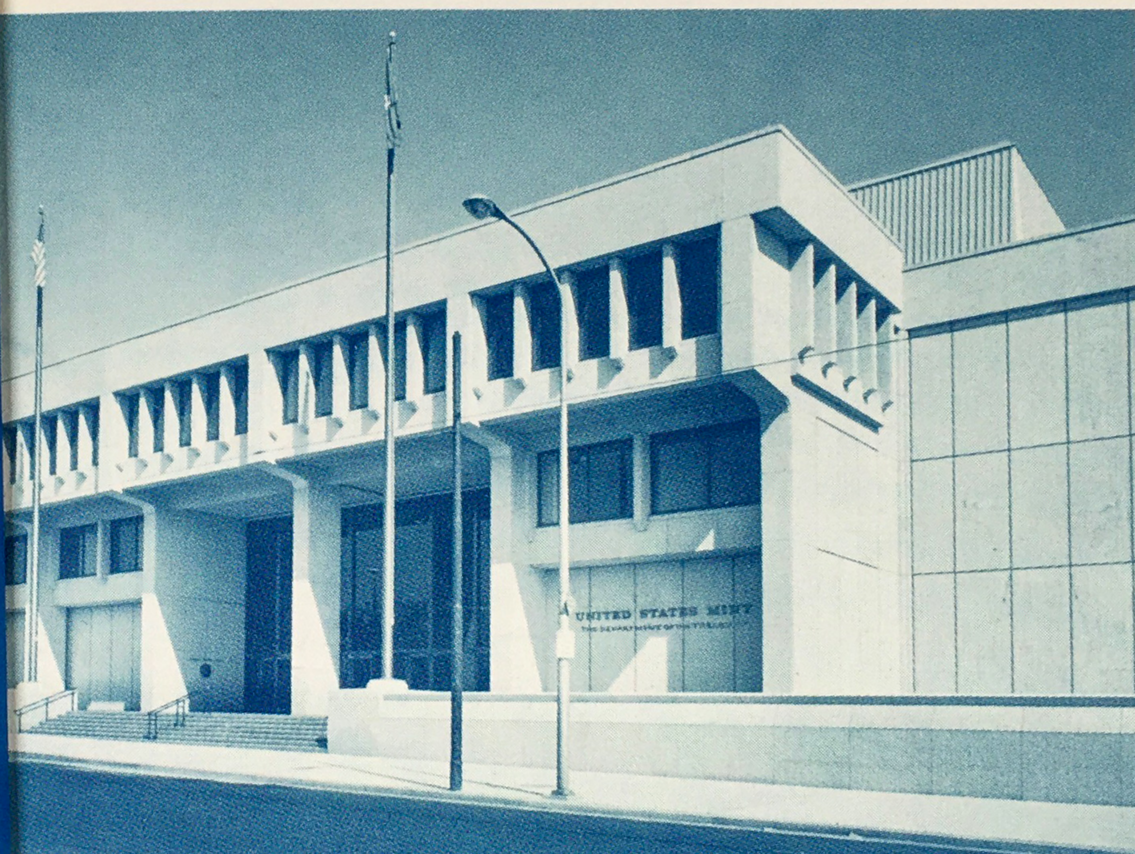
REVEREND DEMETRIOS S. KATERLIS
GREEK ORTHODOX CATHEDRAL OF ST. GEORGE
PHILADELPHIA

☆

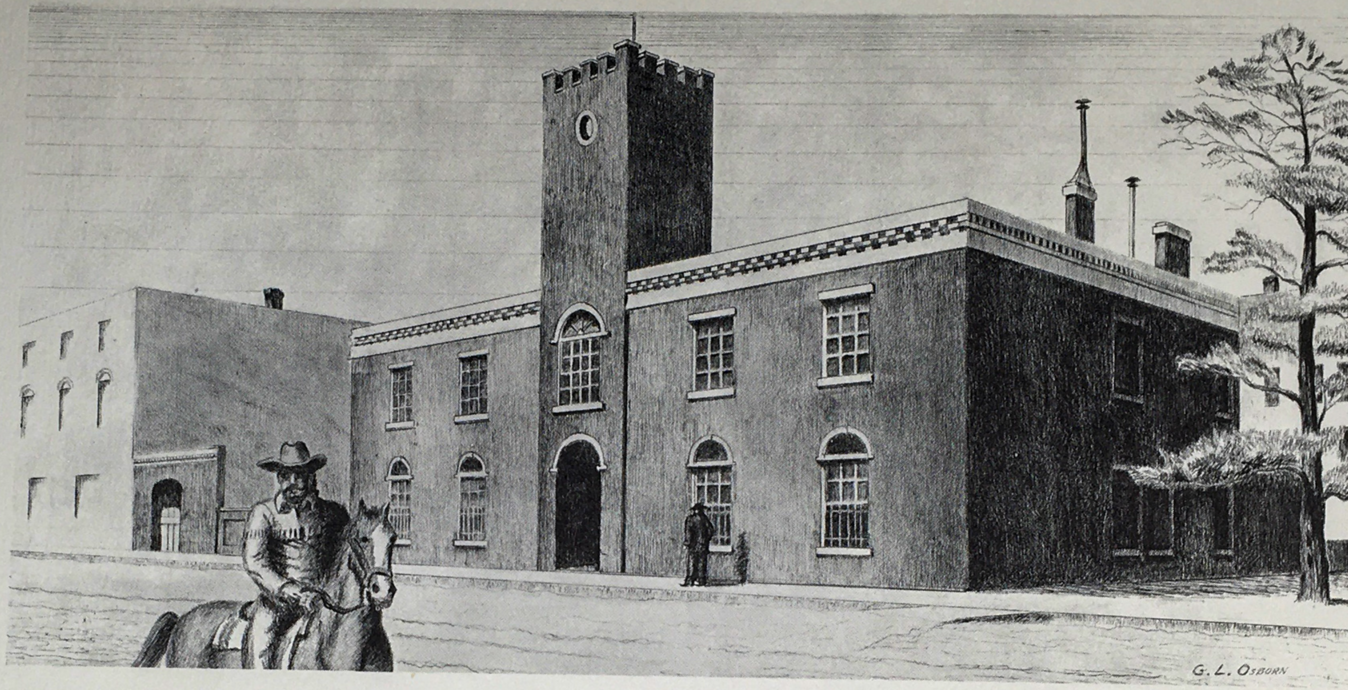
Musical Selection

THE DEPARTMENT OF THE TREASURY

1789

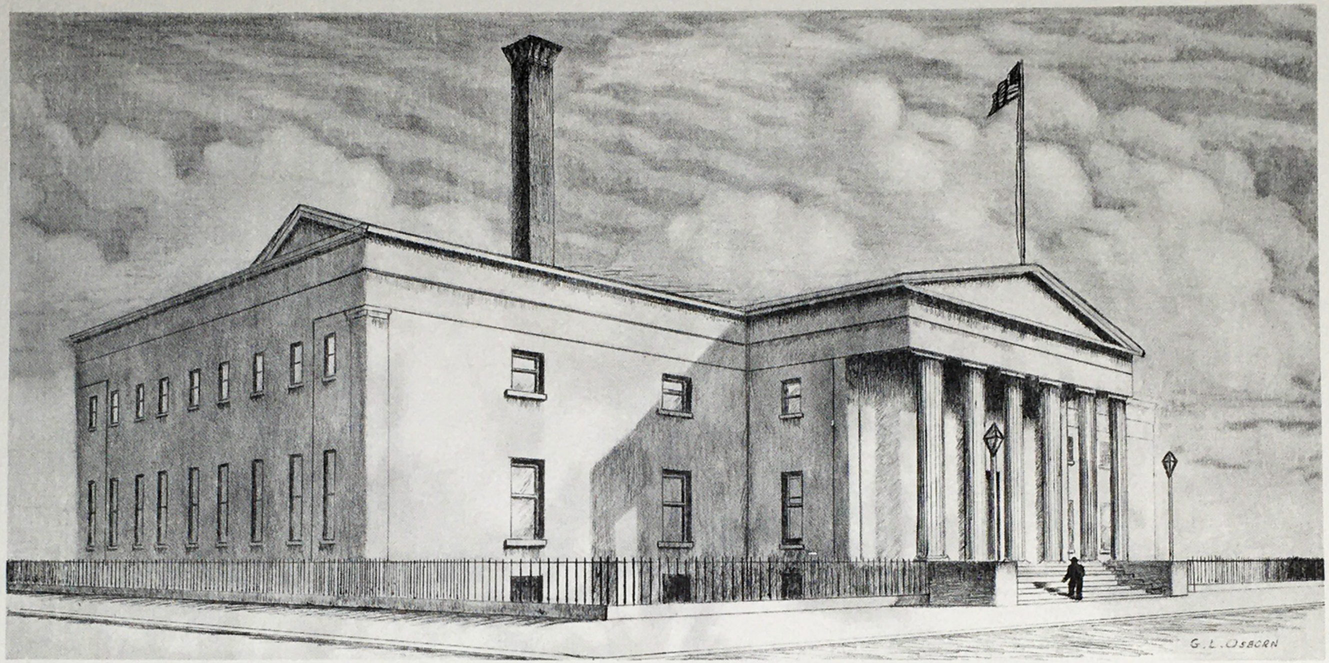

UNITED STATES MINT

BUREAU OF ENGRAVING AND PRINTING.



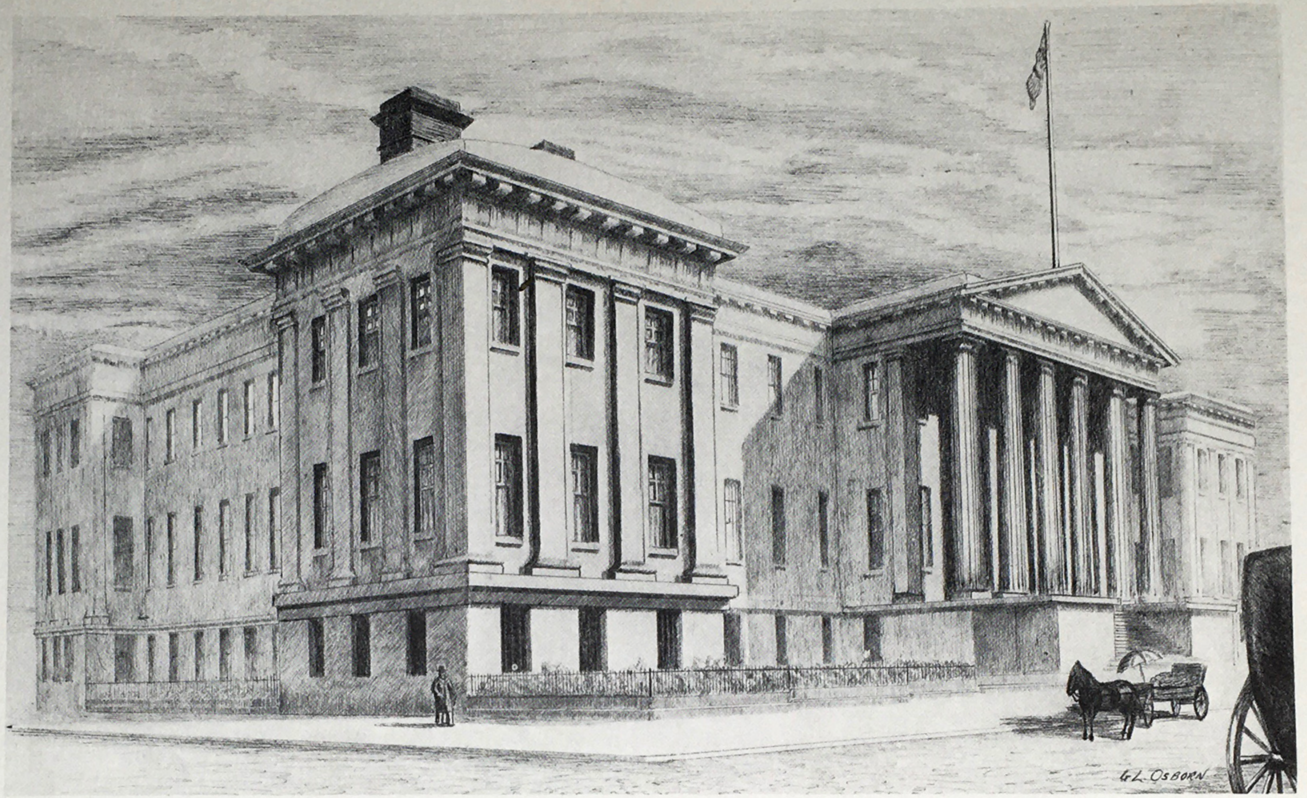
THE UNITED STATES MINT
Denver, Colorado
1862-1904

The history of this building began in July, 1860 as the Clark-Gruber private mint and as such produced private or "pioneer" gold issues in $2.50 to $20.00 pieces. One of these, the "Pike's Peak" $20.00 of 1860 is valued in excess of $5,000.00 and is in the fabulous Lilly collection which reposes at the Smithsonian under the watchful and learned eyes of Dr. and Mrs. V. Clain-Stefanelli. It had the official status of Assay Office until 1877 when the structure was declared unsafe.



THE UNITED STATES MINT
Chestnut and Juniper Streets, Philadelphia, Pa.
1833-1901

Like an ancient temple of Olympus, our second mint stood proudly in the "City of Brotherly Love," recalling such names as Penn . . . Franklin . . . Independence Hall . . . and the Liberty Bell. It was here that the most famous of all Morgan Dollars were minted – 880 of the Proof 1895 – and the 12,000 uncirculated? Had they escaped the melting pot would they not have appeared before now? Not to be overlooked are the beautiful pattern silver dollars of Christian Gobrecht, minted in 1836, and the 1804(?) dollars of which only 15 are known, probably struck some time after 1836.

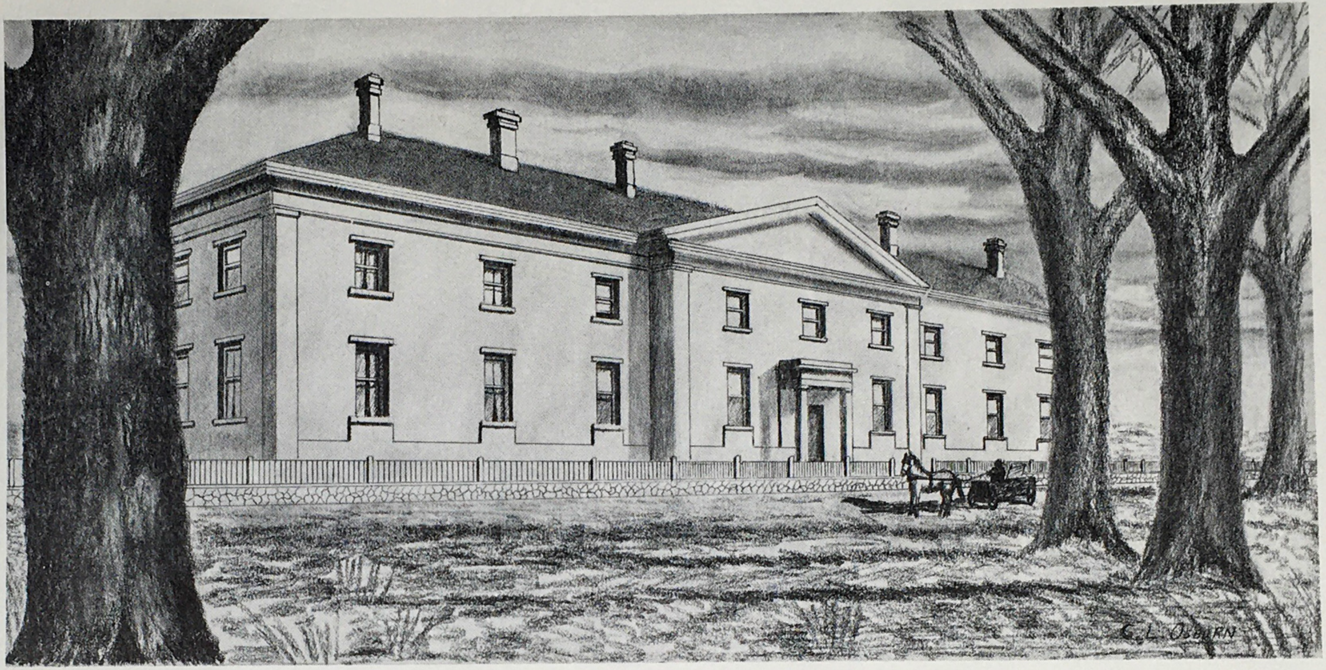


THE UNITED STATES MINT

Fifth and Mission Streets, San Francisco, California
1874-1937

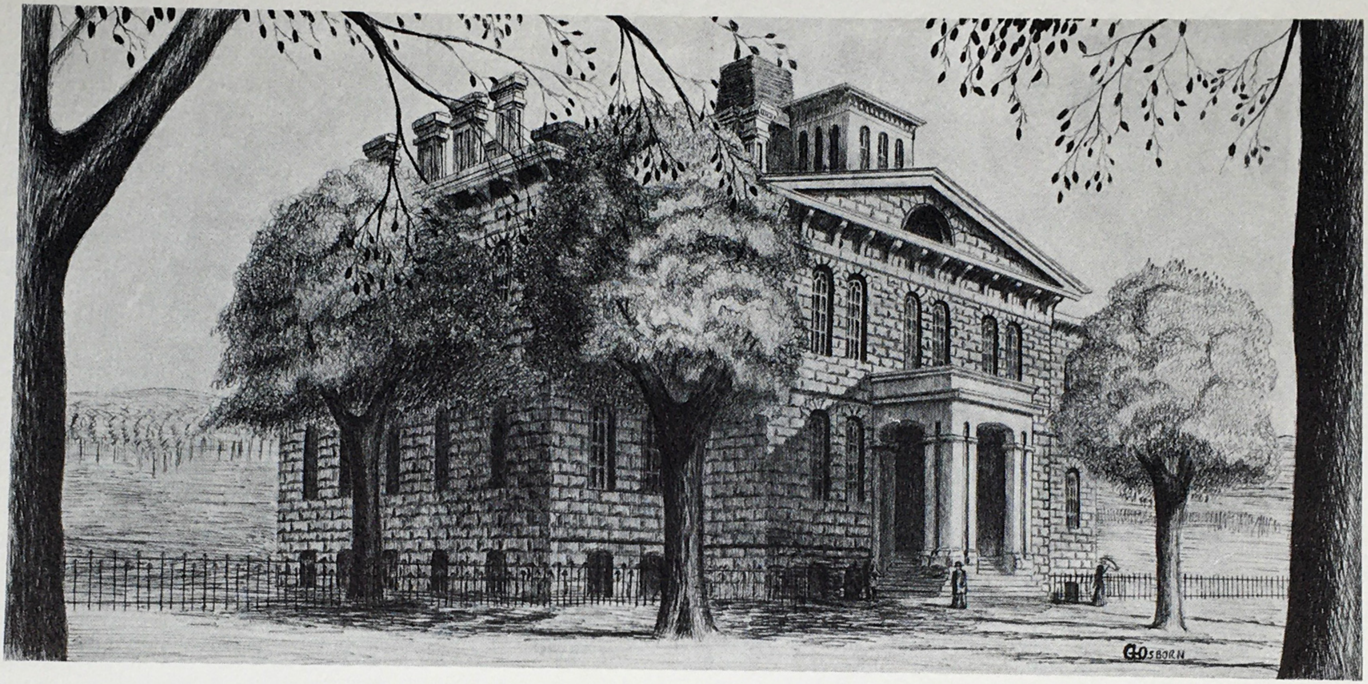
This 97-year-old institution has withstood all the destructive forces of nature including the earthquake of 1906 and the resulting fire. In the wake of this disaster which all but destroyed the banks of the city, the mint served all financial needs of the city during the emergency. The only bank to survive the disaster was the little Bank of Italy, later to become the Bank of America.

From within these walls have come such numismatic rarities as the Barber Dime of 1894 (mintage 24), the Seated Liberty Half of 1878 (mintage 12,000), and the Morgan Dollar of 1893 (mintage 100,000).



THE UNITED STATES MINT
Dahlonega, Georgia
1838-1861

Dahlonega – a magic name for collectors of gold coins. This was the second of the two "gold only" mints. One who would aspire to collect the gems of this mint must be ambitious, persevering, and it won't hurt to be rich. The half-eagles of just one decade, the 1850's, total \$2800.00 in uncirculated condition. This is just a beginning, the dollars totaling \$12,225.00. The uncirculated quarter-eagles total \$13,565.00 – and they skipped a year (1858). Only one \$3.00 gold piece is needed, the 1854, which is labelled \$3,000.00 in uncirculated condition. Good Luck!

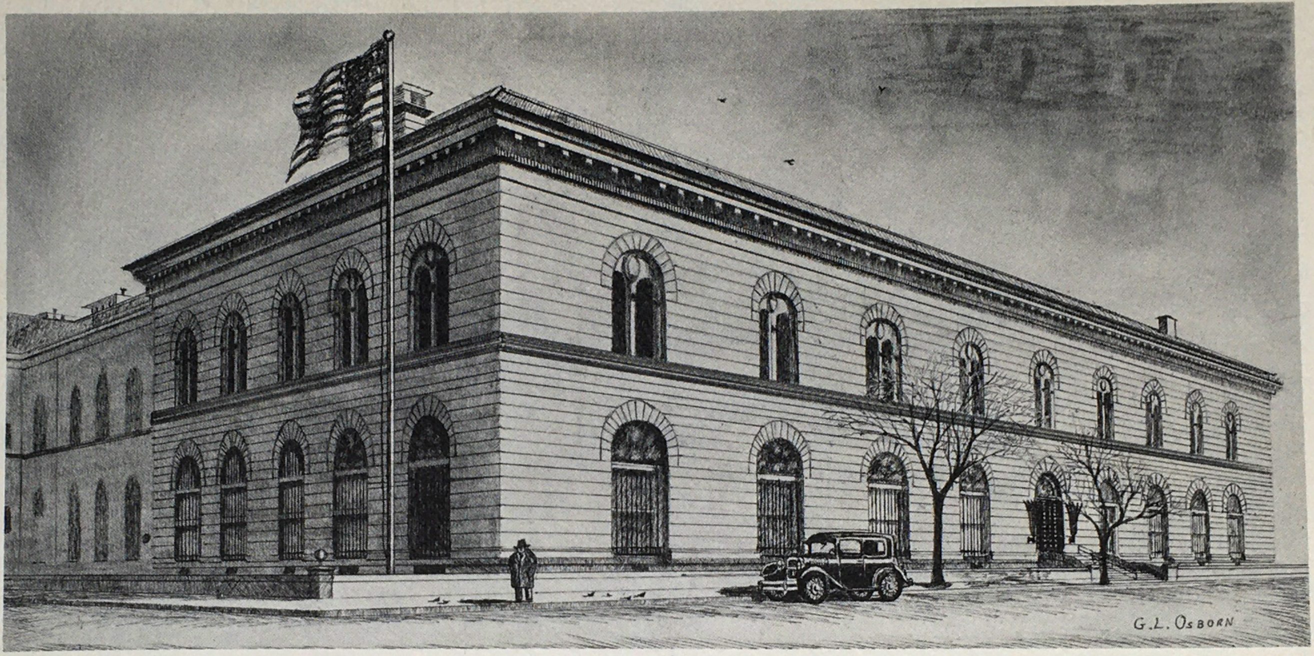


THE UNITED STATES MINT

Carson City, Nevada

1870-1933

Little did the people employed at this picturesque, now famous minting institution, nor did the collectors of the day, realize the degree of desire that the coins, and especially the dollars of their manufacture, would stimulate in today's followers of the exciting hobby known as numismatics. The mere mention of "Carson City Dollars" is usually enough to open the eyes of any collector, short of raising the dead. In addition to the coveted Morgan Dollars we have the Carson City Mint to thank for the Half Eagle of 1878 (cat. $1,300.00), the Quarter of 1873 ($1,800.00), the Eagle of 1879 ($2,000.00) the Seated Liberty Dollar of 1871 ($2,600.00), the Double Eagle of 1870 ($10,500.00), the Twenty-cent piece of 1876 ($16,000.00), and last, but certainly not least, the unique 1873 Seated Liberty Dime (Unpriced).



THE UNITED STATES MINT
West Colfax and Evans Streets, Denver, Colorado
1904-

Although the second Denver Mint is not the largest, its employees can take pride in the fact that their production is seldom matched or surpassed by any other. In 1971 they produced a total of 4,234,423,916 coins for regular circulation.

As impressive as is the quantity produced, modern day collectors take pride in the ownership of some of their rarities as well. Among these, elusive in gem condition, are the Mercury dime of 1916, the Walking Liberty halves of 1921 and 1938, the 3-Legged Buffalo of 1937 and the Jefferson nickels of 1939 and 1950.

Regards to Frank and Julia Gasparro -
George L. Osborn

FRANK GASPARRO

SURVEY OF THE ENGRAVING DEPARTMENT.

I WISH TO ESTABLISH FACTS THAT WILL BEAR LIGHT UPON A FEW ISSUES THAT CONFRONTED THE ENGRAVING DEPARTMENT IN 1970-71-72

1971

1. THE ENGRAVING DEPARTMENT WAS STUCK WITH 5¢-850 OBVERSE DUAL DIES AT THE LATTER PART OF 1971.
SAN FRANCISCO PUT AN ORDER FOR 1000 PAIR OF DUAL NICKELS - AS EARLY AS DECEMBER 1970 WE RUSHED TO PRODUCE THESE DIES AND HOLD THEM. SF STOPPED REQUESTING DUAL NICKELS IN SPRING 1971 - WE HAD 850 OBVERSE 5¢ TO DESTROY AT THE END OF THE YEAR - NO CANCELLATION CAME. I PLEADED WITH D/M OFFICE TO OPEN THE ORDERS IN OCTOBER 1971 TO NO AVAIL. THEREFORE THE DESTRUCTION RESULTED.
2. THE STRIKING OF DOUBLE ONE CENT 1972 WAS OUT OF MY RESPONSIBILITY - THIS CONDITION AROSE WHEN DIE MFG SUPERVISORS ORDERED THE STRIPPING OF DIE LUGS AFTER 1ST. ANNEAL TO CREATE GREATER PRESSURE I WOULD HAVE CONDEMNED THIS PROCEDURE THEREFORE THE MINT WAS CAUGHT WITH THIS "DOUBLING" INCIDENT.
3. I WAS AGAINST MAKING A NEW 5¢ HUB IN THE MIDDLE OF THE 1972 YEAR - NO (2) HUBS ARE THE SAME - BUT THERE IS (1) MASTER DIE. THE OLD HUB APPEARS WORN - SHALLOW BORDER AFTER MANY BANGINGS - THE NECK POINT WAS

(2) RETOUCHED (NOT BY THE ENGRAVER)

(ALL U.S. HUBS ARE GIVEN TO THE DIE MFG. SUPV. (DIVISION HEAD) ON JANUARY 2ND TO BE PLACED IN HIS CUSTODY.)

THE NEW HUB SHOWED SHARP DETAIL, SHARP NECK POINT SHARPER HAIR TAIL AND DEEPER BORDER THEREFORE, THE OUTSTANDING CONTRAST AS DISCERNED BY FRISCO MINT. THERE ARE 2 DIFFERENT TYPES OF 5¢ DIES 1972 — OLD AND NEW, ON HAND

4. WHEN THE ENGRAVER RECEIVED WORD OF THE TELEGRAM SENT TO MR. THEODORE FROM MR. MACDONALD 9/18 HE WAS GRAVELY CONCERNED —

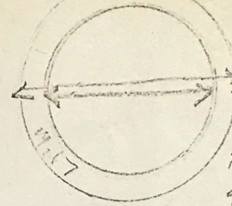
THERE WAS A LACK OF COMMUNICATION INVOLVED. HE WAS TO INFORM MR MACDONALD CONCERNING EXPEDITING DIES AND MEDALS (OF TREASURY LAND MARK AND SECTY SHULTZ) BY SEPTEMBER 15TH. IF NOT POSSIBLE TO PLEASE INFORM MR. MACDONALD.

DR. HUNTER INTERCEDED SINCE HE WAS LOWER IN COMMAND AND LAISON MAN.

ON SEPTEMBER 11TH AND DAILY AFTER MR. GASPARRO INFORMED DR. HUNTER THAT THE JANVIER MACHINES WERE HAVING DIFFICULTIES AND DEADLINE COULD NOT BE MET. A LATER DATE WAS SET.

I THEREFORE CALLED DR. HUNTER THAT COMMUNICATIONS BROKE DOWN ALONG THE WAY — AND I WAS CONCERNED WITH THE RESULT OF RIPRIMAND BY TELEGRAM — THIS SITUATION SHOULD HAVE BEEN CLEARED.

OBVERSE



5,700
4 3/4
TO 4 7/8

ONE DOLLAR

COIN: 1.425 INSIDE DIA.
.013 HEIGHT OF RELIEF
.013 HEIGHT OF BASE FROM I.D. EDGE

MODEL: 4 TO 1 RATIO
5.700 - INSIDE DIA.
.052 HEIGHT OF RELIEF
.052 HEIGHT OF BASIN FROM I.D. EDGE

HALF DOLLAR

COIN: 1.132 INSIDE DIA.
.014 HEIGHT OF RELIEF
.012 HEIGHT OF BASE FROM I.D. EDGE

MODEL
5.03 TO 1 RATIO 5.700 INSIDE DIA.
.070 HEIGHT OF RELIEF
.060 HEIGHT OF BASIN FROM I.D. EDGE

QUARTER DOLLAR

COIN: .893 INSIDE DIA
.019 HEIGHT OF RELIEF
.019 HEIGHT OF BASE FROM I.D. EDGE

MODEL
6.38 TO 1 RATIO 5.700 INSIDE DIA.
.121 HEIGHT OF RELIEF
.121 HEIGHT OF BASIN FROM I.D. EDGE

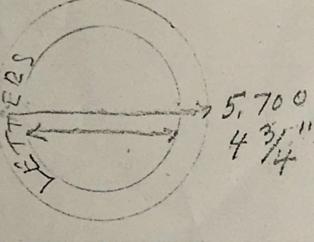
DIME

COIN: .650 INSIDE DIA
.013 HEIGHT OF RELIEF
.013 HEIGHT OF BASE FROM I.D. EDGE

MODEL 8.76 TO 1 RATIO - 5.700 INSIDE DIA
.1138 HEIGHT OF RELIEF
.1138 HEIGHT OF BASIN

REVERSE

ONE DOLLAR



COIN: 1.425 INSIDE DIA
.010 HEIGHT OF RELIEF
.016 HEIGHT OF BASE FROM I.D. EDGE

MODEL: 4 TO 1 RATIO
5.700 INSIDE DIA
✓✓ .040 HEIGHT OF RELIEF
.064 HEIGHT OF BASIN FROM I.D. EDGE

HALF DOLLAR

COIN: 1.132 INSIDE DIA
.010 HEIGHT OF RELIEF
.018 HEIGHT OF BASE FROM I.D. EDGE

MODEL
5.03 TO 1
5.700 INSIDE DIA.
✓✓ .050 HEIGHT OF RELIEF
.090 HEIGHT OF BASIN FROM I.D. EDGE

QUARTER DOLLAR

COIN:
.885 INSIDE DIA.
.010 HEIGHT OF RELIEF
.017 HEIGHT OF BASE FROM I.D. EDGE

MODEL
6.44 TO 1 RATIO
5.700 INSIDE DIA.
✓✓ .064 HEIGHT OF RELIEF
.109 HEIGHT OF BASIN FROM I.D.

DIME

COIN: .650 INSIDE DIA.
.006 HEIGHT OF RELIEF
.008 HEIGHT OF BASE FROM I.D.

MODEL: 8.76 TO 1 RATIO 5.700 I.D.
✓✓ .0529 HEIGHT OF RELIEF
.070 HEIGHT OF BASIN

TURNING OPERATION -

The die is now fastened by the extreme lower end (base) in a 4 jaw chuck on an engine lathe and very carefully centered so that the inner edge of the border of the design runs true to center and the flat on the border runs 90° true to the axis. This is done by eye using magnification and a small pointer, accuracy to within .0001". After centering, the excess steel is turned off and the die is finished according to dimensions shown on submitted drawings in separate folder.

After turning the body of the die, it is placed in a 3 jaw chuck on an engine lathe with the base in position for cutting off to the specified length using gauges.

After turning, a different number is assigned to each die and this is stamped directly on the shoulder of the soft die and a record is kept of these numbers.

Dies prepared for single press operation are now ready for hardening. Dies being prepared for Phila. Mint dual operation are placed in a fixture on a milling machine and an accurate flat is milled into the base.

Dual dies for Denver are ready for hardening after turning to specified dimensions.

The small 'D' Mint mark is stamped, separately by hand, in the proper location on either the Obverse or Reverse of all U. S. coinage dies intended for the Denver Mint just prior to hardening.

HARDENING OPERATION -

The dies are hardened by again packing in hardwood charcoal in individual nichrome cups and placing in a hardening furnace. The temperature is brought up to 1475° and the dies are allowed to soak at this temperature about one hour per inch of die diameter.

The dies are then removed from the cups with tongs and placed face down in the correct hole in the quenching fixture. This consists of a large tank containing a pipe system and a nozzle 2½" diameter pointing upward. This nozzle is oriented directly under a hole in the lid on the tank. Around this hole on the underside is a cylindrical baffle approximately 1½" deep x 3" in diameter to concentrate the water stream around the face and neck of the inverted die. An automatic device for mixing hot and cold water to a predetermined temperature and a quick opening valve are external parts of this quenching device.

At the instant the red hot die is inserted face down in the proper opening, the valve is opened manually and water preheated, from 70° to 76° F., under pressure, about 40 lbs. per square inch, is forced against the face of the die through the nozzle. To check the excess water from spraying around the clearance in the opening, an asbestos pad is held over the tongs and the base of the die. The die is held in this stream of water until it is cool enough to hold.

The dies are then cleaned on the face by scrubbing with a dilute solution of Hydrochloric Acid (1 part acid to 3 parts water) and pumice soap. The dies are then placed in a tempering furnace (Leeds & Northrup Homo) and kept at a constant temperature of 350° F. for 4½ hours except for 1¢ dies which are kept at 400° for 4½ hours.

They are then removed and tested for hardness and uniformity on a Rockwell Model 'TI' hardness tester, "C" Scale. Proper hardness has been established at between 59 and 61- Rockwell "C".

Single dies for Phila. and dual dies for Denver are given a final close inspection for nicks, dents, pits, scale etc. and are then ready for setting in the coin presses or for shipment to Denver.

GRINDING OPERATION - PHILADELPHIA DUALS -

Dual dies for Phila. are precision ground on the neck, the body, across the flats and across the base to exact dimensions so that they are interchangeable in Phila. dual die holders.

After this precision grinding operation and final inspection, Phila. dual dies are then ready for delivery to the Coining Division for fitting in dual die holders and setting in the presses.

DESCRIPTIVE LITERATURE OR SPECIFICATIONS ON ALL MAJOR EQUIPMENT USED IN THE U. S. MINT ENGRAVING DIVISION IS SUBMITTED HEREWITH EXCEPT THE FOLLOWING -

Hydraulic Press Serial #8698
made by Watson Stillman Co.
600 ton capacity Dwg. Nos. 124-127
CC-41-333-A
CC-41-333

Universal Grinder (Cylindrical Grinder)
made by Brown & Sharpe Model #1
Dwg. Nos. 2165 B.P., 2515 B.P.

MATERIALS OTHER THAN STEEL - ENGRAVING DIVISION, U. S. MINT

Hardwood charcoal - Cliffchar - Grade #2
from Cliffs Dow Chemical Co., Marquette, Mich.
or Adams Coal, Phila. for charging gas generator
Charmo gas furnace

Hardwood charcoal - Grade #10 and Bone charcoal pulverized
#DCM for packing dies - from Bell Industries,
Phila., Pa.

Hydrocarbon fluid for electric furnace
'Homocarb fluid' from Leeds & Northrup Co.,
Ft. Washington Industrial Park,
Ft. Washington, Pa.

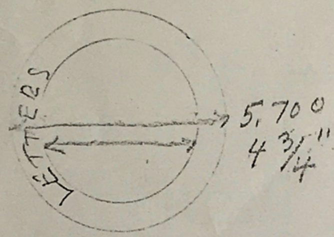
MINOR SUPPLIES

Pure lard to mix with bone charcoal in packing dies
Hydrochloric Acid for cleaning dies - General Chemicals, Phila.
Pumice soap
Nichrome cups and boxes, custom made, Driver-Harris, Harrison, N. J.
Abrasive cloth and paper, various grades
Gravers, files, lathe cutting tools, lubricating oils
Magnifying glasses 3X
Alcohol - industrial

REVERSE

ONE DOLLAR

COIN : 1.425 INSIDE DIA
.010 HEIGHT OF RELIEF
.016 HEIGHT OF BASE FROM I.D. EDGE



MODEL : 4 TO 1 RATIO
5.700 INSIDE DIA
√√ .040 HEIGHT OF RELIEF
.064 HEIGHT OF BASIN FROM I.D. EDGE

HALF DOLLAR

COIN : 1.132 INSIDE DIA
.010 HEIGHT OF RELIEF
.018 HEIGHT OF BASE FROM I.D. EDGE

MODEL
5.03 TO 1
5.700 INSIDE DIA.
√√ .050 HEIGHT OF RELIEF
.090 HEIGHT OF BASIN FROM I.D. EDGE

QUARTER DOLLAR

COIN :
.885 INSIDE DIA.
.010 HEIGHT OF RELIEF
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MODEL
6.44 TO 1 RATIO
5.700 INSIDE DIA.
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COIN : .650 INSIDE DIA.
.006 HEIGHT OF RELIEF
.008 HEIGHT OF BASE FROM I.D.

MODEL : 8.76 TO 1 RATIO 5.700 I.D.
√√ .0529 HEIGHT OF RELIEF
.070 HEIGHT OF BASIN

AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION (MINT PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	A - PACKING EQUIPMENT				
1.	Packing paper for Mint Proof Coins 1 MIL Mylar or equal with 1/10 MIL Polymer coating plus 1/½ MIL Polyethylene extruded in coils of 3" breadth	Standard Packing Corp. 1 Lisbon Street Clifton, New Jersey	1900 lbs.	$1.10 per lb.	$2090.00
2.	2 semi-automatic sealing machines each should be delivered with a die conforming with the set of current coins and the other die conforming with the set of commemorative high dam set.	Mercury Packaging Machinery Corp. 2601 No. Howard Street Philadelphia, Pa. Hercules Products Inc. 12th & Brown Streets Philadelphia, Pa. PO 5-2975 PO 5-2933	2	$1500.00 each	$3000.00
3.	4 foot operated sealing machine sealing bar size about 8" x 1/4" - 220 V. - A. C. - 50 N	William B. Sanford Inc. 115 No. Brookfield Road Cherry Hill, New Jersey	4	$175.00	$700.00
	B - MATERIALS FOR DIE PRODUCTION				
1.	Motor Set for Proof Polishing Dies				
	a. Dumore Power Flex Catalog No. 6-012 Serial No. 8145-1056 220 V. 2 amps A.C. 0 to 50 cycles cont. 40°C rise no load R.P.M. 20,000	Dumore Company Racine, Wisconsin	2 pcs.	$125.00 each	$250.00
	b. Foot Rheostat No. 2-246 220 V. for variable speeds	"	2 pcs.	$50.00 each	$100.00

AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION (HALF PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	B - MATERIALS FOR DIE PRODUCTION (Continued)				
	c. Hand pieces for above with collets and attachment to hold arbors of 1/8" - 1/4"	Dumore Company Racine, Wisconsin	2 pcs.	$65.00 each	$130.00
2.	Arbors				
	a. Arbor R-406-0031	Dumore Company Racine, Wisconsin	100 pcs.	$.20 ea.	$20.00
	b. Arbor 3/32" diam. for felt disc	William S. Waples 115 So. 8th Street Philadelphia, 6, Pa.	2 doz.	$.20 ea.	$4.80
3.	Elgin Cartridge Diamond Compound	Elgin National Watch Co. 107 National Street Elgin, Illinois			
	a. 18 gram tube No. 9 medium green 6-12 mesh These tubes should be delivered accompanied with one cartridge holder pump.		10 tubes	$99.00 per tube	$990.00
	b. 18 gram No. 3 medium yellow 1-5 mesh These tubes should be delivered accompanied with one cartridge holder pump.	" " "	4 tubes	$66.00 per tube	$264.00
4.	Emery Polishing Paper	3M Minnesota Mining and Manufacturing Co. St. Paul, Minn.			
	a. 3M 2/0 paper grit		1000 sheets	$.10 per sheet	$100.00
	b. 3M wet or dry TRI-M-ITE paper grit 320A	" " "	1000 sheets	$.10 per sheet	$100.00
	c. Polishing paper for Proof Coin Dies 4/0 paper	Behr Manning Division Norton Company 4732 Stenton Avenue Philadelphia, Pa.	200 sheets	$.20 per sheet	$40.00

[illegible] MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION (HALF PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	B. MATERIALS FOR DIE PRODUCTION (Continued)				
5.	Mexican Hair Felt Sheets of 5/8" thickness of approximate 1" x 1½"	Quaker City Felt Company 1734-36 Ludlow Street Philadelphia 3, Pa.	10 lbs.	$4.55	$45.50
6.	Hole Saw				
	Hole saw No. 505 -- hole size 1-1/8"	Misener Manufacturing Company, Inc. Syracuse, New York	1 pc.	$20.00 per pc.	$20.00
7.	Poplar wood - lumber yard - of 1/2" thickness	Ideal Lumber Company 479 No. 4th Street Philadelphia, Pa.	4 cu. ft.		
8.	Brass Brushes No. 13-460	William S. Waples 115 So. 8th Street Philadelphia, Pa.	4	$1.75 ea.	$7.00
9.	Solid Felt Wheel Buffs				
	#14-712 - 1½" dia. 1/4" thick	" " "	10 doz.	$.25 ea.	$30.00
10.	Burnishers Straight Blade				
	#15-001½" with 1½" blade	" " "	4	$1.00 ea.	$4.00
11.	Victor Engraving Block				
	#21-201 complete with attachments and leather pad	" " "	1	$71.25 each	$71.25
12.	Pocket Coddington Magnifiers				
	#22-020½ focus 20X	" " "	10	$8.00 ea.	$80.00
13.	Engravers Glass Magnifiers				
	#22-297 lens dia. 1-5/8" power 3.5X	" " "	4	$4.25 ea.	$17.00

AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION, ([illegible]) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	B - <u>MATERIALS FOR DIE PRODUCTION</u> (Continued)	William S. Waples 115 So. 8th Street Philadelphia, Pa.			
14.	<u>Arkansas Bench Stone</u>				
	#44-505 length 5", width 1-7/8"	" " "	2	$8.75 ea.	$17.50
15.	<u>Hard Arkansas Slip</u>				
	a. Triangular 3½" x 1/4" No. 44-593	" " "	12	$1.40 ea.	$16.80
	b. Square 3½" x 1/4" No. 44-583	" " "	12	$1.40 ea.	$16.80
16.	<u>Arkansas Pencil</u>				
	#44-549 length 7"	" " "	12	$2.40 ea.	$28.80
17.	<u>India Triangular Slips</u>				
	#44-693 4" x 1/4"	" " "	6	$.95 ea.	$5.70
	Square slips No. 44-683 4" x 1/4"	" " "	6	$.75 ea.	$4.50
18.	<u>India Pencils</u>				
	#44-649	" " "	6	$1.35 ea.	$8.10
19.	<u>Scotch Stones</u>				
	a. No. 44-822 1/4" square	" " "	4 doz.	$.30 ea.	$14.40
	b. No. 44-820 1/8" square	" " "	5 doz.	$.25 ea.	$15.00
	<u>Clip-On Binocular For Engraver</u>	By Telesite U. S. A.			
	Binocular 3X lens adapter +3 diop Total power 4-3/4 X approx. local range 6½"	The Telescope Loupe	2 pcs.	$35.00 ea.	$70.00

AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION, (MINT PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	C – EQUIPMENT FOR FOUNDRY AND PRODUCTION				
	1. Foundry				
	– Graphite rods for deoxidizing 2" diam. electrodes, Acheson graphite grade A6, 2" x 24"	National Carbon Company Div. of Union Carbide 270 Park Avenue New York, N. Y.	10 doz.	$2.84 ea.	$340.80
	– Becker Synthetic Graphite between 1/2" and 1½" mesh	Becker Brothers Graphite Cicero, Illinois	2000 lbs.	$19.25 per 100 lbs.	$385.00
	– Pyrometer for control and measurement of temperatures ranging from about 800°C to 1500°C	Leeds & Northrup Company Fort Washington Industrial Park Fort Washington, Pa. Honeywell General Sales and offices 3345 W. Hunting Park Ave. Philadelphia, Pa.	3 pcs.	$250.00 per pc.	$750.00
	– P-CU phosphorous copper 15% deoxidizer	Ajax Metal Division of H. Kramer and Company Frankford Avenue and Richmond Streets Philadelphia, Pa. 19123 (215) REgent 9-1490 – – – – – Metallurgical Products Co. 35th and Moore Streets Philadelphia, Pa. 19145	5 Kg.	$1.50 per Kg.	$75.00
	2. Washing and Burnishing	Oakite Products 42 So. 15th Street Philadelphia, Pa.			
	Oakite 3 or 103		1/4 ton	$2.29 lb.	$1280.00
	Cream of Tartar	American Tartar Corp. 420 Lexington Avenue New York, N. Y. 10017	1/2 ton	$.30 lb.	$330.00
	Soap Bark (powdered)	S. B. Penick and Company 103 Church Street New York, N. Y. 10008	1/4 ton	$.42 lb.	$231.00

AUXILIARY MATERIALS AND EQUIPMENTS REQUIRED FOR DIES PRODUCTION, (MINT PROOF) COINS

ITEM NO.	DESCRIPTION AND SPECIFICATIONS	U.S.A. SUPPLIERS	QTY.	APPROX. COST	REMARKS
	C – EQUIPMENT FOR FOUNDRY AND PRODUCTION (Cont.)				
	2. Washing and Burnishing (Continued)				
	Burnishing Media ball cones 1/4"	De Burr Company, Inc. 808 West York Street Philadelphia, Pa.	1 ton	$1100.00 per ton	$1100.00
	3. Production of Coins				
	– Cotton gloves	Albert W. Pendergast 6913 Tulip Street Philadelphia, Pa. 19135	100 doz.	$2.25 per doz.	$225.00
	– Diamond Tweezers No. 47-516 medium points of about 7" length		2 doz.	$1.50 ea.	$36.00

PROCEDURE FOR FINISH TURNING QUARTER DOLLAR SINGLE DIES (CARBIDE TOOL)

1. Tools required - "Aloris" tool-post type CX or CXA with holder.
   Toolholder - "Carb-O-Lock" type TGR-12-3 (3/4" x 3/4" shank) or TGR-10-3 (5/8" x 5/8" shank).
   Insert (Tip), triangular, 1/32" tip radius, grade 350, type TNMG-322E.

2. Grip die in collet with approximately 2-1/8" extended.

3. Turn long taper as follows:

   (a) Roughturn, taking .060 cuts with spindle speed of 1200 R. P. M. and .009 feed.
   (b) Finish turn taking a final cut of .005 to .010 at 1200 R. P. M. and .0045 feed, until taper is correct length when checked with (new) gauge. (Note: For each .004 cut taken (.008 reduction in diameter), taper will increase 5/32" in length (approx.).

4. Rough turn neck and 30° taper as follows; (For a Philadelphia Reverse Die)

   (a) Set machine spindle speed at 1200 R. P. M. and feed at .009.
   (b) Position tip of tool at a point 5/8" back from face of die and with spindle rotating, touch tool lightly to work (thus scribing a line on piece).
   (c) Take a cut .040 deep up to the mark.
   (d) Continue to take a series of .040 cuts, stepping back the length of each succeeding cut .040, until neck diameter of die reaches .957 (.020 plus). Note: During the stepping operation, keep checking the length of the neck. If you have reached a length of 5/16" from the front of the die to the point at which you stopped the last cut, before the .957 diameter is reached, take the remainder of the cuts up to that point (until .957 diameter is reached).
   (e) When the .957 diameter and 5/16" length is reached, keep the tool in this same position and at same dial setting at which last cut was taken, then using the compound (which is set at 30°), turn the angle by hand feed.
   (f) When this angle cut has been completed, traverse the carriage back from the die and return tool to the dial setting at which the last cut on neck (to .957 diam.) was taken - ready for the finish turning of neck and short taper.

5. Finish-turn neck and short taper as follows:

   (a) Use spindle speed of 1200 R. P. M. and .0045 feed (the die neck at this point is approximately .020 plus).
   (b) The first finishing cut should reduce the diameter by .010 and should end 21/64" (1/64" over 5/16") from the face of the die (hand feed tool for first 1/64" of cut then engage feed).

This is probably the most important part of the procedure since it not only allows you to control the feed so that practically no burr is thrown up on the edge of the border, but also allows you to control the formation and direction which the chip takes, so that there should be practically no scratching of the die face. Once you have feed the tool past the face of the die 1/64" or so, engage the feed at that point - do not traverse the tool back and skim this surface again.

Follow above procedure for all (3) finishing cuts on the die neck.

(c) Before taking another cut, deburr the edge of the border to remove the fine feather edge using a 1/4" square carborundum type M1 stone.

(d) Take a second cut to reduce the neck diameter an additional .005 to the same point as first cut (21/64" length), and deburr the the edge again, before taking last finishing cut.

(e) Take a third cut to remove the last .005 or whatever is required to bring the neck diameter to .936 (.001 allowance for expansion when hardening).

(f) Stop spindle (after disengaging feed) at this point, but do not traverse carriage back.

(g) "Mike" neck diameter and if .937 (.936) diameter is correct size, from this point finish-turn the 30° angle to complete the machining of the die, except for final deburring.

(h) Deburr the border edge as follows (Important):

(1) Do not use the 1/4" square stone used for previous steps.

(2) Use a 1/2" square HF-43 hard Arkansas stone.

(3) Hold stone lightly and at a very slight angle to the face of the die (15° to 20°), so as to avoid touching face of die with stone. Stone with a brushing action across the border of the die.

(4) Examine border edge with a glass to insure that stoning operation just removes the burr leaving a good border with a bare minimum amount of chamfer.

Notes:

1. The proper use of this method will result in high quality dies at a good rate, provided the basic finishing steps are carefully followed.

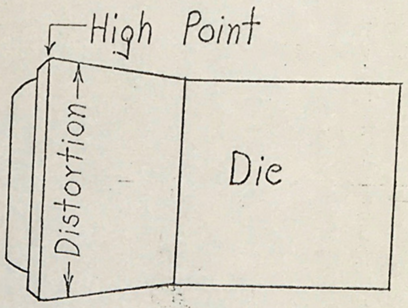
2. Tool life (of carbide tip) will be satisfactory using the speeds and feeds given. Like any tool they will get dull as indicated by size change, different finish, or burr on border edge. When this occurs, index (or replace) the tip. (Considering the cost of the tip, there is no saving in trying to "stretch it" for 1 more piece).

3. As a matter of personal preference, the roughing-out procedure may be varied from that given above, without creating any problems with the finish-turning.

PROCEDURE FOR TURNING BASES (DRIVING) USING CARBIDE TOOLS

1. The following basic procedure should be used for turning the base diameters on all Single and all Dual dies.

2. Tools required:



   (a) Any of the following "Carb-O-Lock" holders:

TYPE NO.	SHANK SIZE	INSERT-(Grade 350)
TGR-10-3	5/8" x 5/8"	3/8" I.C. Triangular
TCR-12-3	3/4" x 3/4"	"
SBR-10-3	5/8" x 5/8"	3/8" Square
SBR-12-3	3/4" x 3/4"	"

3. Set tools correctly to center height. Tool Post should be turned slightly "off-square", so that "TGR" type tools have a slight lead angle (5° to 10° approximately). Type "SBR" tools have 15° lead angle, so tool post is set square to spindle center line.

4. Check "Driver" to insure that it is in perfect condition before starting to work with it and that it is properly seated in headstock spindle.

5. Check live center to insure that it is in proper condition to use it, and properly seated in tailstock spindle.

6. Set machine for 765 R. P. M. and .0072 feed and then carefully mount die between driver and center.

7. With work rotating, touch with tool at the high point as noted on sketch and set micrometer dial at zero. Take a .060 cut, measure this turned diameter and proceed as follows:

   (a) If size is more than .070 over the finished dimension, take the remainder in (2) equal cuts.

   (b) If .070 or less remains to cut to finished size, finish in (1) cut.

8. Before backing tool away from finishing setting, check the dial reading to establish how much material was removed, and then set dial to zero. Then, if the amount of material to be removed is .140 or less, (from touch-off to finish size), divide the amount into 2 equal cuts and mark dial (for first cut).

   (a) Example: Die required the removal of .140 to establish the finished size, tool is in position at which finish cut was taken and dial is set at zero. Back the tool away .070 (removing the back-lash) and mark dial, thus establishing position for first cut (the machine is now set for turning on a production basis). Upon the completion of each finish cut (at zero), back the tool away to the .070 mark (always removing the back-lash in the "feed-in" direction) and traverse carriage back to the position at which cut was started before removing die.

(b) Similarly, if the amount of material to be removed is .140 or more, divide the amount into 3 equal cuts and mark dial to suit. (The 1/4 Dollar and 1/2 Dollar Singles require only (2) cuts. Some of the Duals will require (3) cuts due to the greater amount of distortion of the blank)

9. Points to watch: This method will give excellent results if carefully followed; however, particular attention should be given to the following:

(a) Inspect the "Driver" carefully for possible damage before you use it and at intervals while it is in use.

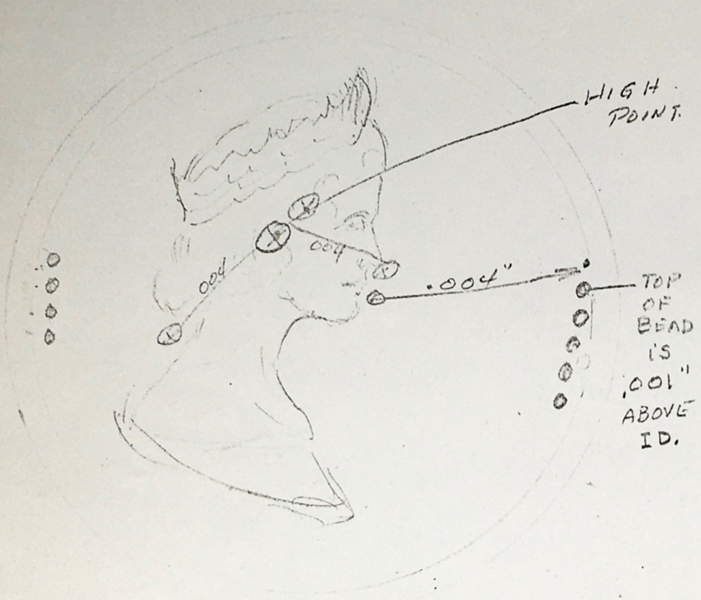
(b) Check the first piece and at intervals thereafter to insure that the portrait of the die is not marred by some defect in the driver or in mounting the die on the driver.

(c) Also check the first piece turned and pieces at random thereafter, for concentricity, by wringing them in a suitable (true-running) collet.

(d) Use a carbide insert with a 1/32" (maximum) tip radius and index it when it begins to get dull or chip. (The use of too large a tip radius and dull tools appear to cause "run-out".)

(e) Lastly, inspect both the live center and the driver (particularly the latter) when you finish using them. If they need attention, or appear to, remove them from the machine and turn over to the supervisor for necessary repair (and ready for use next time).

CANADA - 1¢ OBV.

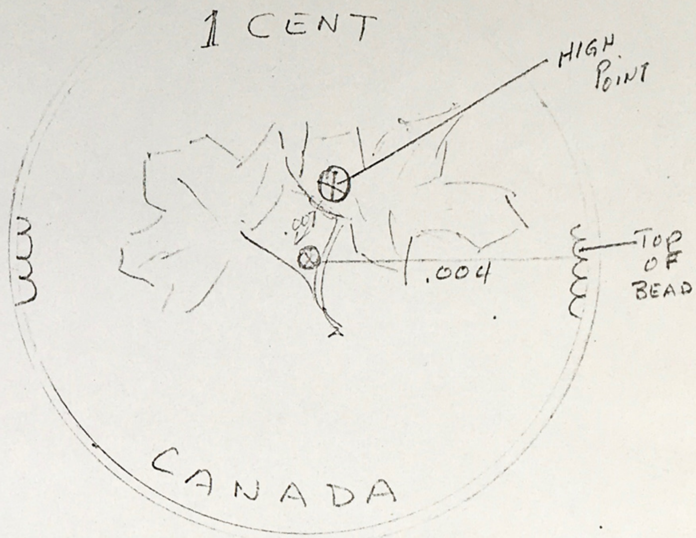


$H/R = .004$

$H/B = .004$

$ID = .700"$

CANADA - 1¢ REV.

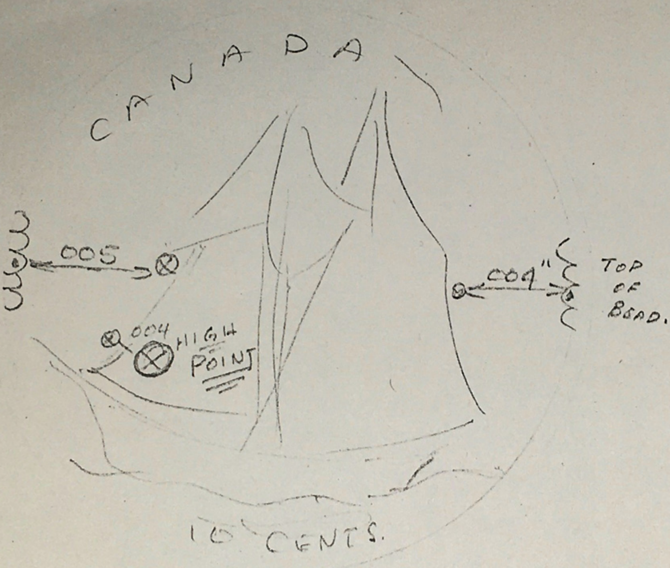


$H/R = .007$

$H/B = .004$

$ID = .700"$

CANADA - 10¢ - REV.

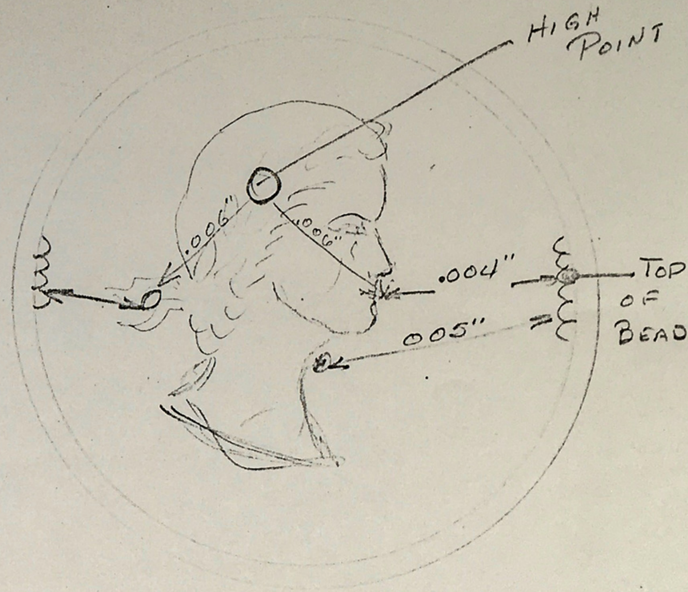


H/R = .004"

H/B = .004" / .005"

ID = .657"

CANADA - 10¢ OBV

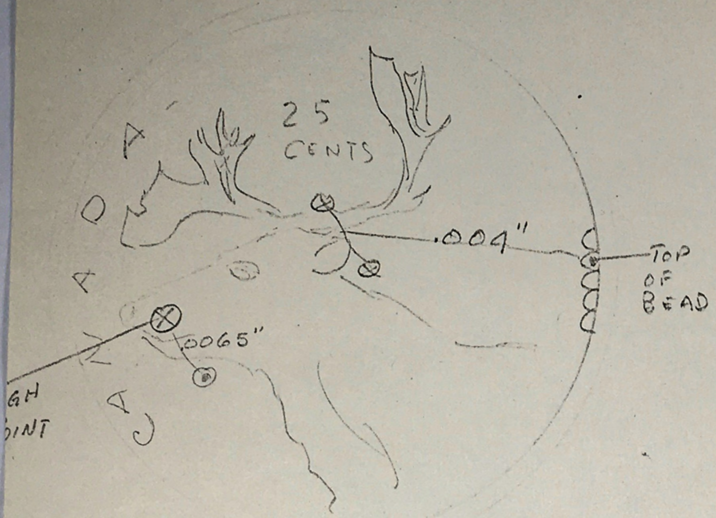


H/R = .006

H/B = .004 / .005

ID = .657"

CANADA - 25¢ · REV.

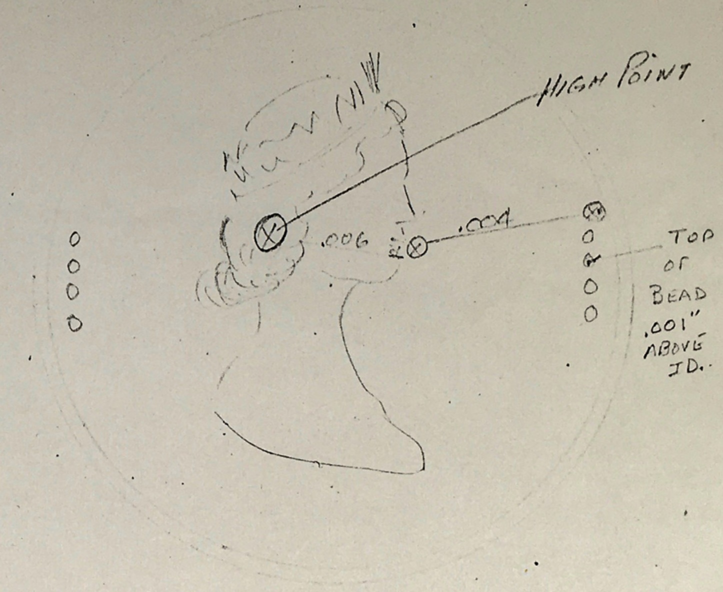


$H/R = .0065"$

$H/B = 004$

$ID = .880"$

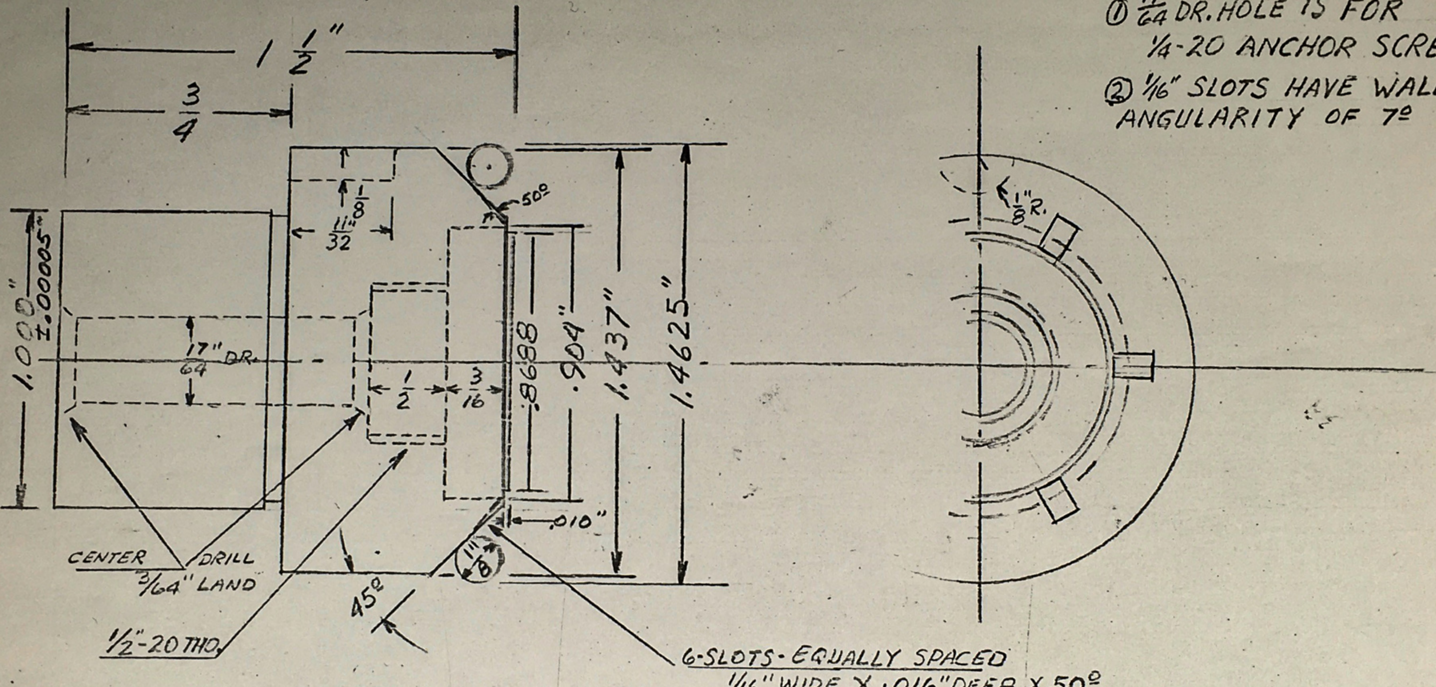
CANADA - 25¢ OBV.



$H/R = .006"$

$H/B = .004$

$ID = .880"$



NOTE

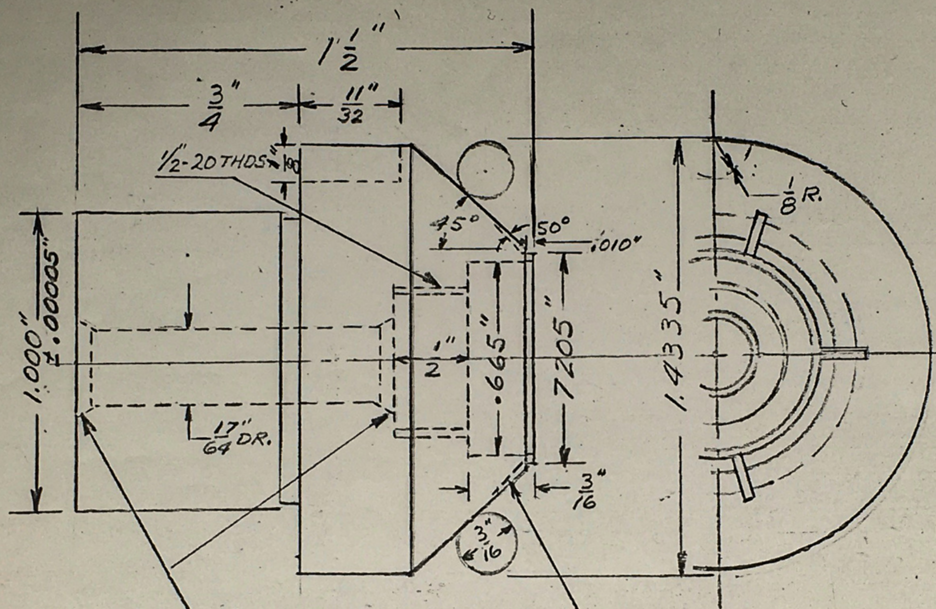
① 17/64" DR. HOLE IS FOR 1/4-20 ANCHOR SCREW.

② 1/16" SLOTS HAVE WALL ANGULARITY OF 7°.

"DRIVER INSERT" QUARTER DOLLAR.

U.S. MINT. - PHILA., PA.	
INSERT - NEST.	
SCALE.	2÷1
DR'W'N BY-	N. GIORDANO

TOLERANCES: FRACTIONAL ± 1/64"; DECIMAL ±.001"; ANGLES ±1°; UNLESS OTHERWISE SPECIFIED.



NOTE.
① 17/64" DR. HOLE IS FOR 1/4"-20 ANCHOR SCREW.
② 1/16" SLOTS HAVE WALL ANGULARITY OF 7°.

"DRIVER INSERT" - DIME DUAL

U.S. MINT. - PHILA., PA.	
INSERT - NEST.	
SCALE.	2 : 1
DR'W'N BY -	N. GIORDANO

TOLERANCES: FRACTIONAL ± 1/64 ; DECIMAL ±.001 ., ANGLES ±1°, UNLESS OTHERWISE SPECIFIED.

F. Gorfano 12/14/66

HEAT TREATMENT OF COINAGE DIES IN THE ENGRAVING DEPARTMENT

STEEL

W-1 Steel is equivalent to Air-Melt Carpenter II Vacuum or Air-Melt being used. Best electric furnace product--.96 to 1.05% carbon; shepard hardenability 8 to 10 on 3/4" round to 1450° F; water quench fracture grain size 9 or finer; annealed at 140-150 Brinnel maximum or Rockwell-B 87°; heat-treated, water quenched and hardened to Rockwell-C Scale 61.5°.

COINAGE DIE PROCESS

1. The coned blank is processed by the Conomatic 8-spindle turret lathe from 10' steel round bars 1-5/16" - 1-1/2" - 1-5/8" dia. preannealed 170 Brinnel maximum to sizes:
   Dual Blanks - 1-5/16" dia. x 2-7/8" height
   Single Blanks - 1-1/2" or 1-5/8" dia. x 3-1/4" height

2. The coned die blank is then polished with #320 and #400 disc grinding cloth.

3. The die blank is pressed or struck on the hydraulic press using the coinage hub to create the first impression (40 tons pressure).
   Hub hardness - 65.5 Rockwell-C 150-K
   Die Blank hardness - 140-150 Brinnel maximum - Rockwell-B 87°

4. Dies are annealed. Cycle of annealing: The blank has now become work hardened and resists further movement. To relieve this condition, the blank is annealed by packing in hardwood charcoal in nichrome pots 20 dies in each with face down, heated in annealing furnace to 1425° for 4-1/2 hours, then being allowed to cool slowly in a shut-down furnace overnight.
   Heat Control - Automatic temperature control panels -
   3 Leeds & Northrup Speedomax Panels
   1 Honeywell Panel
   Timing - Heat brought up to $\frac{1380°}{1400°}$ - 8 a.m. to 10 a.m.
   Dies are then packed and placed in furnace - 10 a.m.
   Heat shut-down
   Furnace doors open for cooling - 4 p.m.
   Die pots drawn out of annealing on rolling - 12 a.m.
   tray cart for cooling - 6 a.m.

5. Dies are then taken out of pots to cool, then scrubbed or cleaned by soft wire rotating brush - 9 a.m.

6. Dies are then struck (2nd blow). The hub is carefully registered into the existing impression on the die and placed in hydraulic press for 40 tons pressure -
   1¢, 5¢, 10¢ - 2 blows
   25¢, 50¢ - 3 blows

7. Die is carefully examined and surface cleaned.

8. Die Turning - Die is turned very carefully centered so that the inner edge of border of design runs true to center and the flat on border runs 90° true to axis - accuracy .0001.

9. Hardening - Dies are then prepared for hardening in hardwood charcoal in individual nichrome cups, die surface downward, and placed in gas Surface Combustion Furnace. The temperature is brought up to 1475°. This temperature climb takes 2 hours. Die is allowed to soak at this temperature at about 1 hour per inch. The die in the nichrome cup is kept in the furnace for 1-1/2 hours. 20 dies in nichrome cups can be heated in 1 gas furnace.
   Heat Control - Automatic temperature control panels -
   Old Room : 3 Leeds & Northrup Panels
   1 Honeywell Panel
   New Room : 3 Leeds & Northrup Speedomax H Panels

10. Quenching - The cup with the inserted die is taken out of furnace and placed on quenching panel board for 1 second. The die is removed from charcoal cup with tongs and placed face-down in the correct hole or die-sized aperture in the quenching fixture. This consists of a large tank containing a pipe system and a nozzle (1-1/2" dia.) pointing upward. This nozzle is oriented directly under a hole on the lid on the tank. Around this hole on the underside is a cylindrical baffle (1-1/2" deep x 3" in dia.) to concentrate the water stream around the face and neck of the inverted die. An automatic device for mixing hot and cold water to the temperature of 75° to 80° at 40 to 60 lbs. per square inch against the face of the die through the nozzle is the external part of this quenching device. To check the excess water from spraying around the clearance in the opening, an asbestos pad is held over the tongs and the base of the die. The die is held in this stream of water until it is cool enough to hold (1 minute per die). The die is checked for hardness--near the surface neck - 65°;
   at the bottom - 50-52° Rockwell C-Scale 150-K - (hardness explanation below).

11. Dies are placed in homo-tempering. (Leeds and Northrup Homo-Furnace) - Dies are kept in for constant temperature of 350° to 400° for 4-1/2 hrs.
   Heat Control - 4 Leeds & Northrup Speedomax Automatic Temperature Control Panels

12. Dies are taken out of Homo-Tempering Furnace.
    Check: <u>Rockwell Hardness</u> -
    Model TT Hardness Tester
    60° - 61° on the top of die around neck
    and 48° - 50° on bottom;
    3/32" - 1/8" depth of hardness penetration

13. This variance of hardness is created to produce a cushion of softness at the bottom of the die to relieve the constant pounding in coinage press. The surface top is required to hold a firm hardness.

14. The dies are cleaned on the face by scrubbing with diluted solution of hydrochloric acid (1 part acid to 3 parts water) and pumice soap. Also, we had success in cleaning the surface of dies by using a soft wire rotating brush. <u>It is required that no scaling is found on dies after hardening and quenching</u>.

15. The final operation required is for inspection of dies and surface cleaned, with a fine abrasive stick of #320 and #400 paper. Single dies are now ready for coin press. Dual dies require grinding of body and neck of dies to specified dimensions--grinding an average of .005 off; to a die tolerance of .0005 plus or minus.

PRESENT NUMBER AND CAPACITY OF FURNACES

<u>7 Heat-Treating Hardness Furnaces</u> -

<u>Old Area</u>
#1 - Surface Combustion Gas Furnace, 5' x 7', heats 20 dies every 2 hrs.-3 shifts
#2 - Surface Combustion Gas Furnace, 5' x 7', " " " " " " " "
#3 - Electric (box-type), 5' x 7', " " " " " " " "
#4 - Gas Furnace, Hevi-Duty, 5-1/2' x 7', " " " " " " " "

<u>New Area</u>
#5 - Surface Combustion Gas Furnace, heats 20 dies every 2 hrs. - 3 shifts
#6 - Surface Combustion Gas Furnace, " " " " " " " "
#7 - Surface Combustion Gas Furnace, " " " " " " " "

Our present requirements - 400 dies hardened daily

<u>4 Gas Annealing Furnaces</u>

3 - Big Furnaces - 6' x 8-1/2' anneal 220 dies each on a 24 hour cycle
1 - Surface Combustion Furnace - anneals 60 dies on a 24 hour cycle -
720 dies on 3 shifts

<u>4 Homo-Tempering Furnaces</u>

1 - Homo - 5 baskets @ 30 dies in each - 150 dies every 4 hours
4 - Homos - 1 shift = 1200 dies

HEAT TREATING FOR HARDENING

The limit of critical point of exposure in air of the die (before quenching) is 5 to 10 seconds from furnace. 5 seconds from cup to water (from the time the die in the nichrome cup is taken out of the furnace to the point where the die is inverted and quenched). Once the die is exposed and the heated die cools below 1350°, it loses its hardenability. In developing equipment possibly for multiple quenching, faster movement of trays holding dies from furnace to the quenching unit must be developed.

SINGLE AND DUAL DIE QUENCHED

Hardness Rockwell test--before tempering

Die neck at top	- 65-67°
Side of die (center)	- 59-61°
Bottom of die	- 54-57°

SINGLE AND DUAL DIE AFTER TEMPERING

Die neck at top	- 59-61°
Side of die (center)	- 55-57°
Bottom of die	- 49-51°

* * *

Descriptive literature of specifications on heat equipment in the Engraving Division is submitted herewith:

MATERIAL

Hardwood Charcoal - Cliffchar, Grade #2 - For charcoal gas generator, Charmo Gas Furnace
From: Cliffs Dow Chemical Company, Marquette, Michigan -or- Adams Coal, Phila., Pa.

" " Grade #10 and bone charcoal pulverized, #DC XX - For packing dies
From: Bell Industries, Phila., Pa.

Hydrocarbon Fluid - For Electric Furnace
From: Leeds and Northrup

MINOR SUPPLIES

Pure Lard - To mix with bone charcoal in packing dies

Hydrochloric Acid - For cleaning dies
From: General Chemicals
Phila., Pa.

Pumice Soap - For cleaning dies

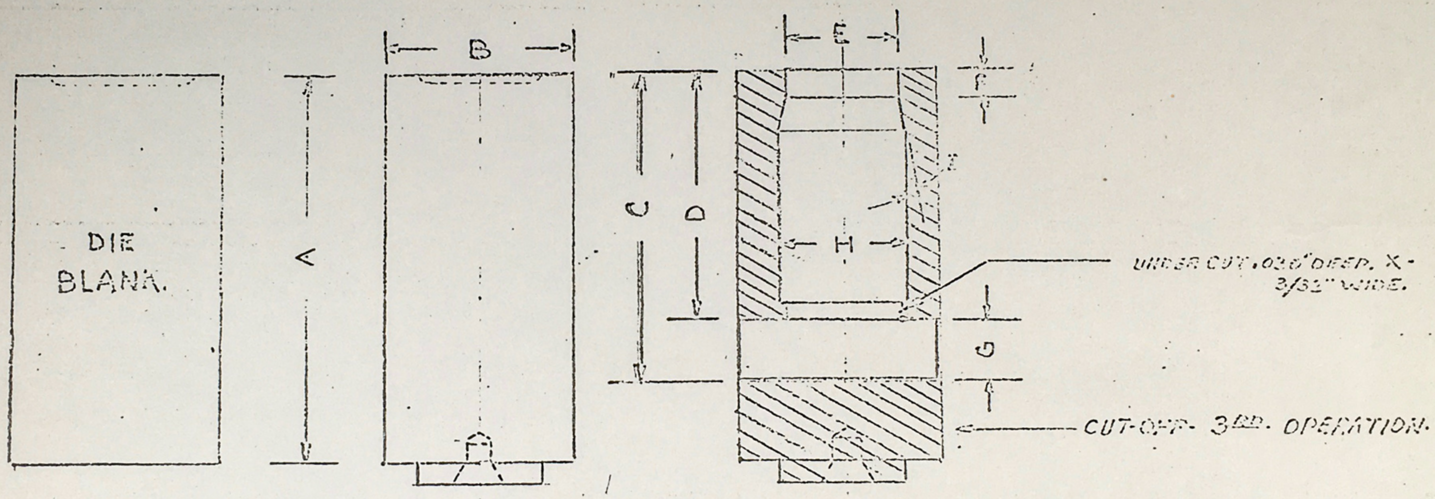
Soft Wire Rotating Brush - " " "

Nichrome Cup and Boxes - Custom-made
From: Driver-Harris
Harrison, N. J.

Alcohol - Industrial

-oOo-

	A	B	C	D	E	F	G	H	I
1¢ OBV.	2.450	1.245	2.050	1.665	.743	3/16	.385	.795"	15°
1¢ REV.	2.450	1.245	2.095	1.710	.743	5/16	.385	.795"	15°
5¢ OBV.	2.380	1.245	2.050	1.675	.828	3/16	.375	.945	9°
5¢ REV.	2.380	1.245	2.095	1.720	[illegible]	5/16	.375	.945	9°
10¢ OBV.	2.520	1.245	2.050	1.675	.693	3/16	.385	.795"	15°
10¢ REV.	2.520	1.245	2.095	1.720	.693	5/16	.385	.795"	15°



FINAL. STRIKE.

1ST. OPERATION

2ND. OPERATION.

TURNING SIZES

U.S. MINT

DUAL DIES

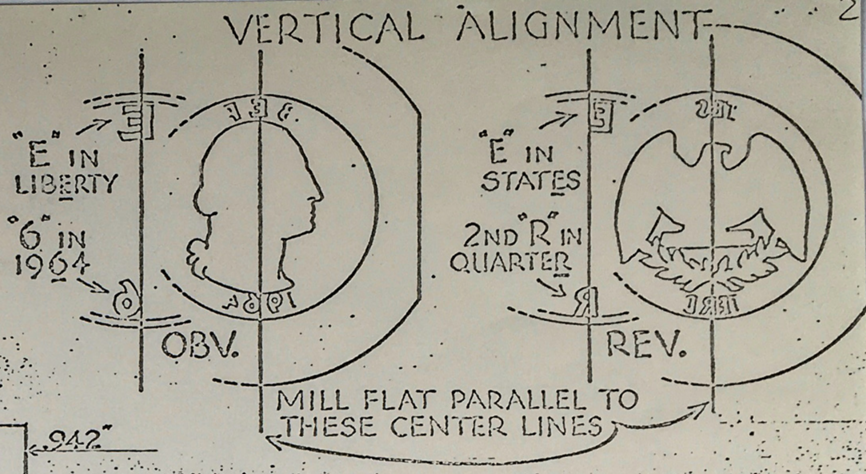
DRWN BY. M.G.CRONO.

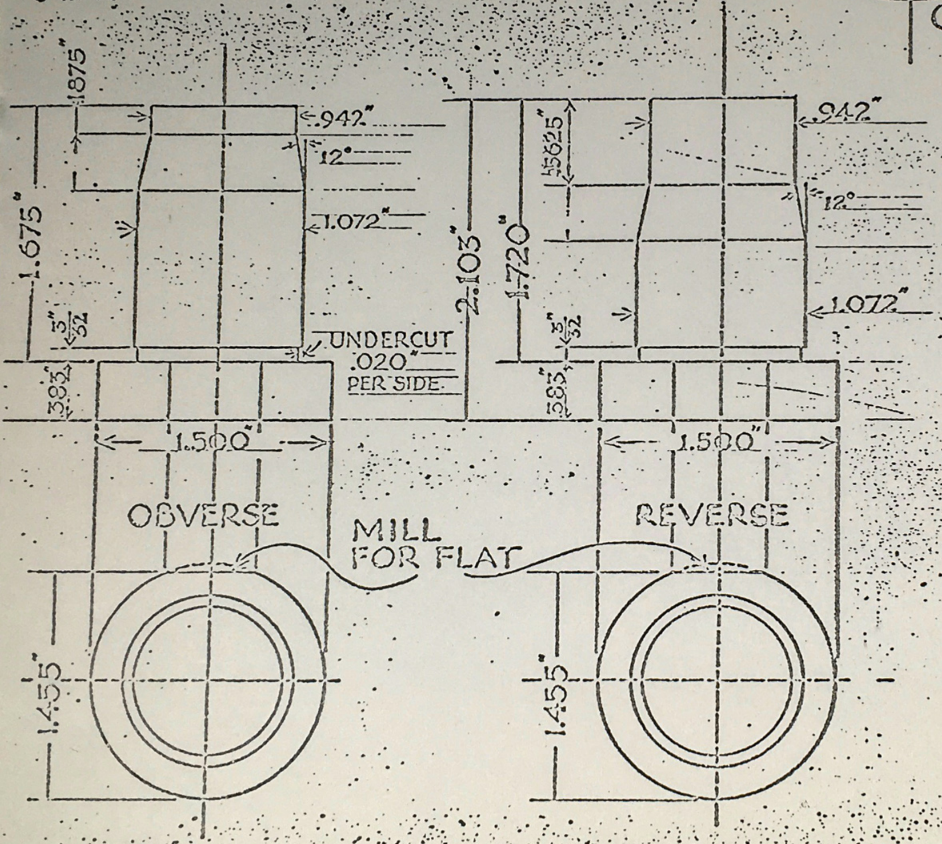
TURNING BEFORE HARDENING

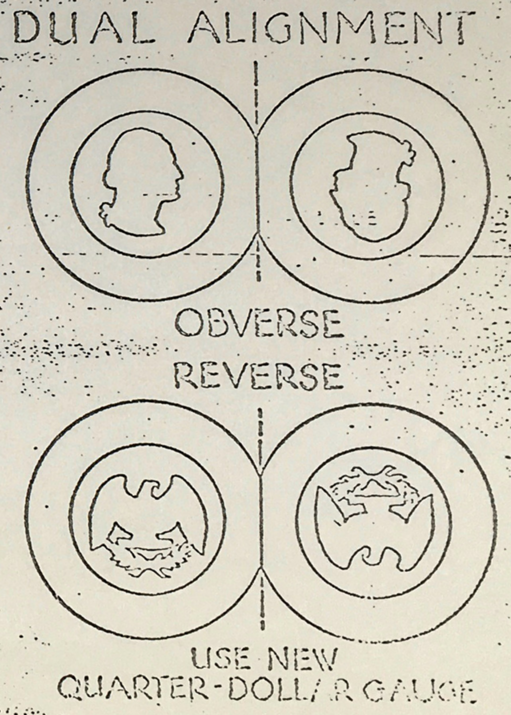
U. S. QUARTER-DOLLAR DUAL DIES

TURNING & MILLING SIZES

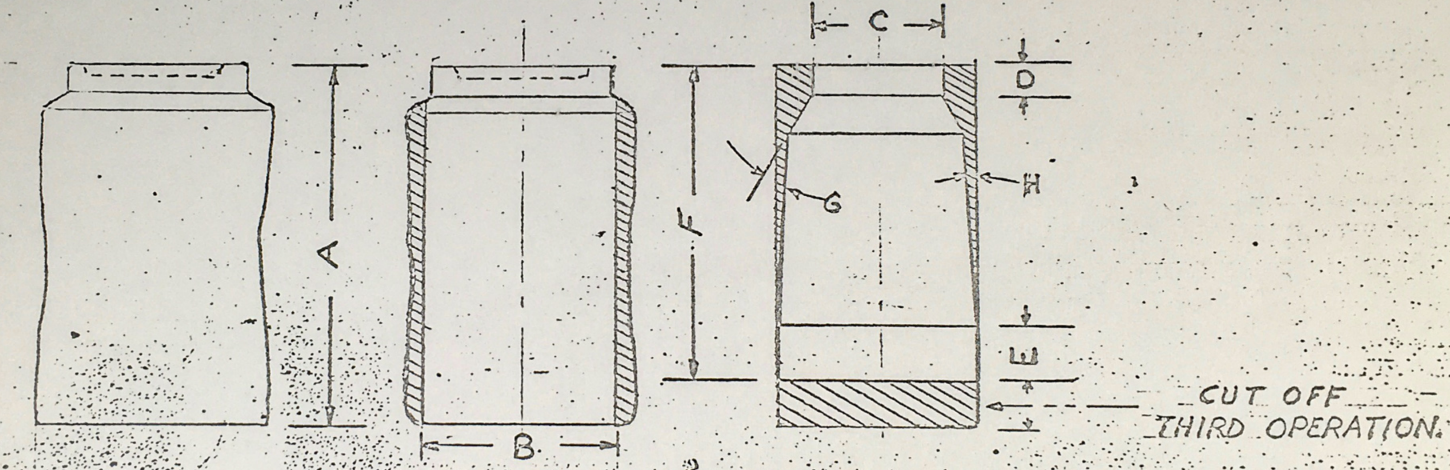
UNITED STATES MINT, PHILADELPHIA, PA.
DESIGNED & DRAWN BY S. D'ALESSIO & E. GROVE
0-12-65







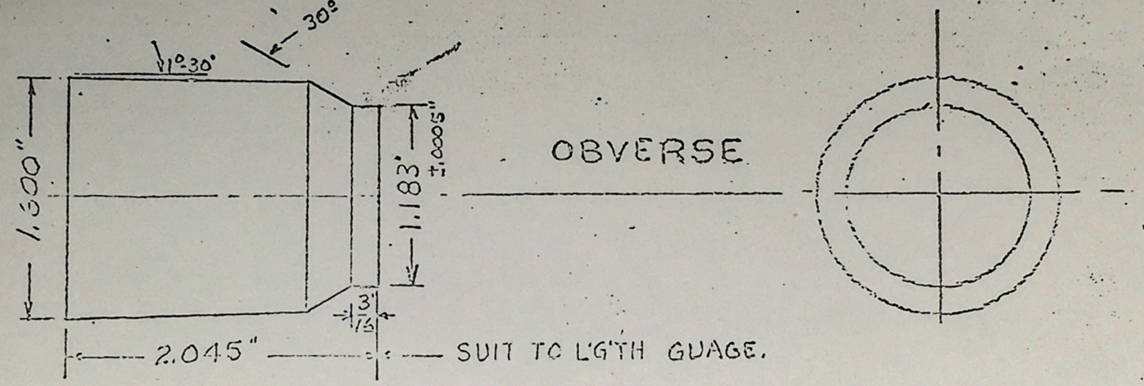
		A	B	C	D	E	F	G	H
1¢	OBV.							30°	1°30'
	REV.							30	1°30'
5¢	OBV.								
	REV.								
10¢	OBV.								
	REV.								
25¢	OBV.	2.625	1.450	.9345	3/16	7/16	2.045	30'	1°30'
	REV.	2.625	1.450	.9345	5/16	7/16	2.090	30'	1°30'
50¢	OBV.	2.750	1.600	1.184	3/16	7/16	2.045	30'	1°30'
	REV.	2.750	1.600	1.184	5/16	7/16	2.090	30'	1°30'

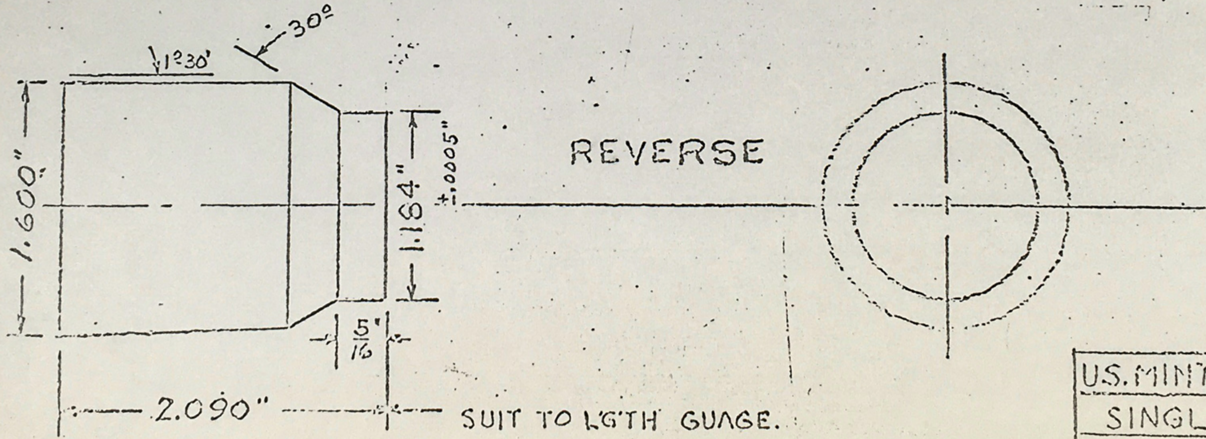


FINAL STRIKE. FIRST OPERATION. SECOND OPERATION.

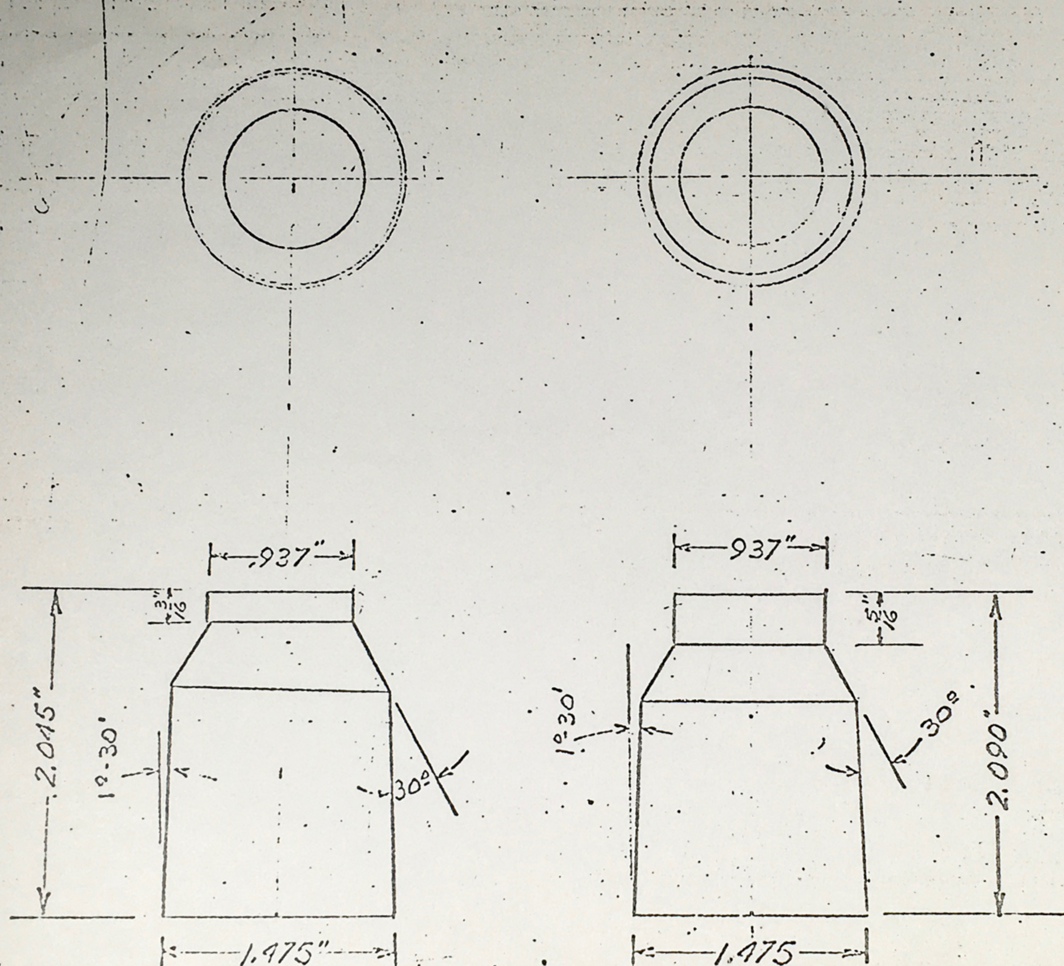
U.S. MINT	
SINGLE DIES.	
DATE:	
CHK.	
DRW'N-	N. GIORDANO

PHILADELPHIA HALF DOLLAR SINGLE DIE - TURNING DIMENSIONS.-





U.S. MINT. - PHILA., PA.	
SINGLE DIE	
SCALE.	FULL SIZE



OBVERSE REVERSE.

NOTE.
TOLERANCES ON DECIMAL DIMENSIONS ±.001, FRACTION DIM. ± 1/64", UNLESS OTHERWISE SPECIFIED.

U.S. MINT. - PHILA. PA	
QUARTER DOL. DIM.	
SCALE.	FULL SIZE.
DR'WN. BY.	N. GIORDANO
CHECKED BY.	

QUARTER DOLLAR TURNING DIMENSIONS

PREPARATION FOR PROOF DIES

Before Hardening

Once the die is turned to the finished diameter on the lathe, the die is inspected for any scratches or bumps. These must be removed from the die face, while the die is soft. This done by steel burnisher, Scotch stone and 2/0 emery polishing paper. Every care is taken to remove any minute speck or scratch before hardening if the die is to be of Proof quality.

Steel burnishers No.15-001½
1½" blade - $1.00 each
Scotch stones #44-820-1/8"sq.
#44-822-1/4"sq. - $.30 each
William S. Waples
115 So. 8th St., Phila., Pa.

Hardening

The die is placed in a cup of charcoal with die surface imbedded upside down into the cup. The die cup with other cups (20) are placed in a surface combustion gas furnace and heated to 1480° for 1½ to 2 hours. The die is taken immediately out of the furnace and pulled out of the cup and inserted upside down into a cavity bushing of a quenching tank with water jetted up to the surface of the die at 60 pounds pressure 80° lukewarm water. The back of the die is covered or cushioned with asbestos pad so the water spraying up through the jet bushing does not touch the back. This soft bottom of the die acts as a cushion for striking coinage pieces in the press.

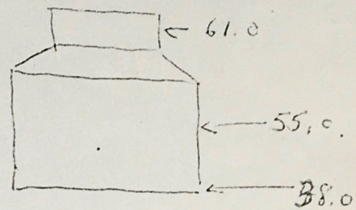
2/0 3M emery paper (1 doz.)
Minnesota Mining Company
St. Paul, Minn.

Homo Tempering

The dies are then placed in Homo-Tempering furnaces to 400°F for four and a half hours to be tempered.

Rockwell Testing

The die is then Rockwell tested all over. This is the reading:
Rockwell 150 KG-C Scale



Proof Preparation

The die is placed in a chuck and ready to be polished.

1. Use the 2/0 paper over surface. Do not touch engraving.
2. If there are scratches evident, use Arkansas stone 1/4 inch square or flat area of Arkansas pencil.
3. Go back with 2/0 paper evenly until all scratches are out.

Arkansas Stone 4" x 1/4" sq.
#44-712 - $.85 each
4" x 1/4" triangle #44-716
W. S. Waples, Phila., Pa.

Proof Polishing 1st application

4. Using a Dumore power flex buffer with a (Poplar) wood 3/4" dia. and 1/2" thick disc held by a Mandrel inserted tight into the Dumore hand piece (using supplied key) medium green, Elgin diamond compound 18 gram Number 9-6 to 12 mesh approx. $99.00 a cartridge, this smeared over the surface of wood disc Mandrel. With a rotating movement the green diamond compound smooths the surface of die until all scratches are erased.

Dumore Power Flex Catalog #6-012
(See list attached)
Mandrels Norton Company
Racine, Wisconsin
Poplar Wood Lumber Company
Elgin National Watch Company
Elgin, Ill.

2nd Applicarion

Using a Mexican hair felt disc attached to a Mandrel inserted in the Dumore hand piece - 3/4" dia. x 1/2" thick diamond compound is applied on surface of felt disc.
Elgin cartridge diamond compound 18 gram <u>yellow</u> 6 to 12 mech approx.
$66.00 a cartridge

Felt Company ?

Elgin National Watch Co.
107 National St.
Elgin, Illinois

Rotating over area of die with this yellow and final compound and felt disc a mirror finish is accomplished and the die surface is washed over with soft cotton impregnated with alcohol. Check the die, if the border has been rubbed or polished, use a scotch stone 1/8" square tip and go around outer edge. Do not touch surface otherwise polishing must be repeated.

For Proof Striking

The die is ready for striking. The operator must use tweezers and must wear white linen gloves at all times. A coin may have to be struck twice to bring up detail using 60 tons blow after 200 to 300 strikes, the die will lose its two tone polish.

Repolishing

The die will have to be immersed in Nitric acid and water solution with a copper penny dropped into a bowl of this solution (to dull its effect).
This will give the die the necessary frosted look.
Now the die is ready for Proof polishing using first the green then the yellow compound, to give a two tone effect.
It is possible to retain the die after two to three repolishing operations.

<u>Nitric Solution</u>

1ST. AND 2ND OPERATION OF TURNING DIES

1. The polished die blank is struck by the hub at a given tonnage. The hub has a series of locating lugs on its face. This enables the re-entry of the hub for the final strike and also for being driven by the driver in the lathe.

2. A driver with the desired lug slots is placed in the spindle of the lathe. The struck die blank is placed against the driver and the tailstock center is placed against the bottom of the die which has a center hole. The die is turned to a specified diameter. This is for construction purposes. This diameter is then placed in a collet. The machine (if it is a tracer lathe) is set with a template and the profiling operation begins. The operator, if using a conventional lathe, must refer to the blueprint for sizes of lengths, angles, and diameters.

3. The turned die is then removed and placed in another lathe for cutting-off the excess length to the desired size.

November 5, 1962

MANUFACTURE OF U. S. COINAGE DIES FROM COMPLETED HUBS
PHILADELPHIA MINT

PREPARATION OF DIE BLANKS -

Annealed tool steel bars, approximately 12 ft. long, are fed into a turret lathe. This machine cuts short lengths from the bar and also shapes one end of these short lengths into a cone. For U. S. coinage, the angles of cone, diameter and length used are shown on drawings included in separate folder. An analysis of the tool steel used is included in the specifications herewith. The rough blanks from the turret lathe are fastened in a 3 jaw chuck on an engine lathe and a leveling cut is taken across the flat end with a slight depression cut in the center for leveling. The cone on these blanks is then fine ground against a rotating steel disc faced with abrasive cloth #Carborundum Aloxite Type 3 320 x Resin Industrial Cloth. This is done by rotating the cone by hand in an adjustable fixture (for cone angle) against the revolving disc. This disc grinder consists of a 7½ H. P. motor mounted on a pedestal. A large 18" diameter steel disc is fastened to each end of the motor shaft. New abrasive cloth is cemented to these discs from time to time as it wears. The rotation speed is 1400 R. P. M.

After removal of lathe tool marks with the disc grinder, the cone is given a finer finish by hand lapping with progressively finer abrasive cloth Nos. 240, 280 and 400 fastened to a wooden lapping stick approximately 6" long x ½" wide x 3/16" thick and then buffing with a fine wire buff.

HOBBING OPERATION -

The finished coned blank is then ready for hobbing. This is accomplished by placing the blank and the hardened hub in a special fixture or subpress so that the inverted hub (face) is in alignment with the center of the cone on the upright blank. The fixture is adjustable so that different diameter blanks and hubs can be made to register center over center. The fixture with blank and hub is then centered on the anvils of a hydraulic press (capacity 700 tons) and pressure is applied, approximately 50 tons for 10¢, 60 tons for 1¢ and 5¢, 70 tons for 25¢ and 90 tons for 50¢. This forces the face of the hub against the cone on the annealed blank causing it to take a negative impression from the positive design on the hub.

ANNEALING OPERATION -

The blank has now become work hardened and resists further movement. To relieve this condition the blank is annealed by packing in hardwood charcoal in nichrome cups and heating in an annealing furnace to 1425° F. soaking at this temperature for 4¼ to 4½ hours and then allowing to cool very slowly in the shutdown furnace, generally, overnight. The annealed die is now carefully cleaned with a dilute solution of Hydrochloric Acid (1 part acid to 3 parts water), hot water and thoroughly scrubbed with pumice soap. The hub is now carefully registered into the existing impression on the die and placed in the hydraulic press for a second blow (squeeze) using the same pressures as before. This procedure is repeated a third time for all U. S. coins except the half dollar which sometimes requires a fourth blow.

The die impression is now carefully examined to make sure complete, all over contact has been made with the design on the hub, that there are no doubles (failure to exactly register) and that it is clean with no foreign inclusions or impressions, scratches, etc.

TURNING OPERATION -

The die is now fastened by the extreme lower end (base) in a 4 jaw chuck on an engine lathe and very carefully centered so that the inner edge of the border of the design runs true to center and the flat on the border runs 90° true to the axis. This is done by eye using magnification and a small pointer, accuracy to within .0001". After centering, the excess steel is turned off and the die is finished according to dimensions shown on submitted drawings in separate folder.

After turning the body of the die, it is placed in a 3 jaw chuck on an engine lathe with the base in position for cutting off to the specified length using gauges.

After turning, a different number is assigned to each die and this is stamped directly on the shoulder of the soft die and a record is kept of these numbers.

Dies prepared for single press operation are now ready for hardening. Dies being prepared for Phila. Mint dual operation are placed in a fixture on a milling machine and an accurate flat is milled into the base.

Dual dies for Denver are ready for hardening after turning to specified dimensions.

The small 'D' Mint mark is stamped, separately by hand, in the proper location on either the Obverse or Reverse of all U. S. coinage dies intended for the Denver Mint just prior to hardening.

HARDENING OPERATION -

The dies are hardened by again packing in hardwood charcoal in individual nichrome cups and placing in a hardening furnace. The temperature is brought up to 1475° and the dies are allowed to soak at this temperature about one hour per inch of die diameter.

The dies are then removed from the cups with tongs and placed face down in the correct hole in the quenching fixture. This consists of a large tank containing a pipe system and a nozzle 1¼" diameter pointing upward. This nozzle is oriented directly under a hole in the lid on the tank. Around this hole on the underside is a cylindrical baffle approximately 1½" deep x 3" in diameter to concentrate the water stream around the face and neck of the inverted die. An automatic device for mixing hot and cold water to a predetermined temperature and a quick opening valve are external parts of this quenching device.

At the instant the red hot die is inserted face down in the proper opening, the valve is opened manually and water preheated, from 70° to 76° F., under pressure, about 40 lbs. per square inch, is forced against the face of the die through the nozzle. To check the excess water from spraying around the clearance in the opening, an asbestos pad is held over the tongs and the base of the die. The die is held in this stream of water until it is cool enough to hold.

The dies are then cleaned on the face by scrubbing with a dilute solution of Hydrochloric Acid (1 part acid to 3 parts water) and pumice soap. The dies are then placed in a tempering furnace (Leeds & Northrup Homo) and kept at a constant temperature of 350° F. for 4¼ hours except for 1¢ dies which are kept at 400° for 4¼ hours.

They are then removed and tested for hardness and uniformity on a Rockwell Model 'TT' hardness tester, "C" Scale. Proper hardness has been established at between 59 and 61+ Rockwell "C".

Single dies for Phila. and dual dies for Denver are given a final close inspection for nicks, dents, pits, scale etc. and are then ready for setting in the coin presses or for shipment to Denver.

GRINDING OPERATION - PHILADELPHIA DUALS -

Dual dies for Phila. are precision ground on the neck, the body, across the flats and across the base to exact dimensions so that they are interchangeable in Phila. dual die holders.

After this precision grinding operation and final inspection, Phila. dual dies are then ready for delivery to the Coining Division for fitting in dual die holders and setting in the presses.

DESCRIPTIVE LITERATURE OR SPECIFICATIONS ON ALL MAJOR EQUIPMENT USED IN THE U. S. MINT ENGRAVING DIVISION IS SUBMITTED HEREWITH EXCEPT THE FOLLOWING -

Hydraulic Press Serial #8698
made by Watson Stillman Co.
600 ton capacity Dwg. Nos. 12A-127
CC-41-333-A
CC-41-333

Universal Grinder (Cylindrical Grinder)
made by Brown & Sharpe Model #1
Dwg. Nos. 2165 B.P., 2515 B.P.

MATERIALS OTHER THAN STEEL - ENGRAVING DIVISION, U. S. MINT

Hardwood charcoal - Cliffchar - Grade #2
from Cliffs Dow Chemical Co., Marquette, Mich.
or Adams Coal, Phila. for charging gas generator
Charmo gas furnace

Hardwood charcoal - Grade #10 and Bone charcoal pulverized
#DCXX for packing dies - from Bell Industries,
Phila., Pa.

Hydrocarbon fluid for electric furnace
'Homocarb fluid' from Leeds & Northrup Co.,
Ft. Washington Industrial Park,
Ft. Washington, Pa.

MINOR SUPPLIES

Pure lard to mix with bone charcoal in packing dies
Hydrochloric Acid for cleaning dies - General Chemicals, Phila.
Pumice soap
Nichrome cups and boxes, custom made, Driver-Harris, Harrison, N. J.
Abrasive cloth and paper, various grades
Gravers, files, lathe cutting tools, lubricating oils
Magnifying glasses 3X
Alcohol - industrial

MANUFACTURING OF COIN AND METAL HUBS AND DIES

Manufacturing method used at United States Mint, Philadelphia - From original artists sketch and model to completed product.

SKETCH

Usually a pencil drawing 3 to 5 times larger than the size of the intended piece. This is prepared by an artist, its purpose is to portray a fairly complete representation of the idea and appearance of the finished piece, composition, arrangement, style, type and size of lettering, purpose, dates, etc.

MODEL

Using the sketch and or photographs, a relief model is made in plastilene (modeling wax) several times larger than the intended piece, separate models are made for the obverse and reverse sides. These are built up on flat boards that have been shellaced, or on plaster discs that have been turned up to include a border and concave basin (field). These are also given a coat of shellac. At this time the height of relief is established keeping in mind the ratio of the model to the finished piece. Much of the lettering and finer detail is left out. It is more practical to do this in the negative.

NEGATIVE PLASTER

The original sculptured model is surrounded by a band or 'fence' of stiff waxed paper or thin metal strip. This is fastened to the board or wrapped around the plaster disc and sealed with additional plastilene. A

very thin film of olive oil or mineral oil is brushed over everything, including the inside of the band. Plaster of paris (gypsum) is mixed with water to the consistancy of thick cream and poured over the model, sufficient to completely cover the highest part of the design by a half inch or more. After the plaster has set, about 45 minutes, it can be lifted away from the plastilene and further work can be done with metal tools in this negative. Final detail and lettering can best be done at this stage.

POSITIVE PLASTER

All undercuts are carefully removed from the negative plaster and it is brushed with a coat of shellac or Opex (Sherwin Williams sanding filler), and after drying, a thin film of petrolatum or Dow Corning #7 compound (silicon lubricant) is applied. A flat band or strip is secured around the outer edge and a creamy plaster-water mix is poured in to 1 inch or more thickness. Jiggling or vibrating the negative during this operation helps to prevent air bubbles. After the plaster has set, the band is removed and by carefully wedging with a knife blade and tapping gently, the two plasters will separate. Final cleaning up and finishing is done at this stage.

GALVANO (ELECTRO-TYPE)

These are copper replicas of the plaster model and are prepared by thoroughly drying the completed plaster model, either negative or positive, and immersing in very hot beeswax until all bubbling ceases, then removing and when nearly cool, dusting with finely powdered copper, getting into all parts of the design and around the outer edge of the plaster. A copper wire is wrapped around this outer edge making contact with the powder. The dusted plaster is then suspended in a copper plating tank, with the wire attached to

the proper bus bar. Copper is plated from solution by electrolysis directly onto the design and plating is continued till a thickness of about 1/16th inch is deposited, about 4 days. The plated plaster is then removed from the tank and the extreme outer edge is cut away on a band saw and the copper electrotype separated from the plaster. After cleaning up and backing with solder or asphalt, it is turned true (flat) on the back, and is ready for clamping to a face plate on the Janvier engraving-reducing machine. These galvanos can also be given a decorative finish by plating or otherwise, and used for exhibit purposes.

HUBS OR DIES

The principle purpose of the galvano is for use as a pattern on the Janvier machine. This machine traces over the design and reproduces all details in reduced size in a piece of annealed tool steel. A positive galvano is used to prepare a hub and a negative glavano for a die. A die cut directly on the machine can be turned to fit the press, hardened and used for striking medals or coins. Where a large run of coins or medals is contemplated, a hub (positive) is made, turned and hardened, and used as a punch or hob in a hydraulic press to form a number of dies. Final diameter is established at this time.

PREPARATION OF DIE BLANKS

Annealed tool steel bars, approximately 12 ft. long, are fed into a turret lathe. This machine cuts short lengths from the bar and also shapes one end of these short lengths into a cone. For U. S. Coinage, the angles of cone, diameter and length used are shown on drawings included in separate

folder. An analysis of the tool steel used is included in the specifications herewith. The rough blanks from the turret lathe are fastened in a 3-jaw chuck on an engine lathe and a leveling cut is taken across the flat end with a slight depression cut in the center for leveling. The cone on these blanks is then fine ground against a rotating steel disc faced with abrasive cloth #Carborundum Aloxite Type 3 320 x Resin Industrial Cloth. This is done by rotating the cone by hand in an adjustable fixture (for cone angle) against the revolving disc. This disc grinder consists of a 7½ H.P. motor mounted on a pedestal. A large 18" diameter steel disc is fastened to each end of the motor shaft. New abrasive cloth is cemented to these discs from time to time as it wears. The rotation speed is 1400 R.P.M.

After removal of lathe tool marks with the disc grinder, the cone is given a finer finish by hand lapping with progressively finer abrasive cloth Nos. 240, 280 and 400 fastened to a wooden lapping stick approximately 6" long x 1/2" wide x 3/16" thick and then buffing with a fine wire buff.

HOBBING OPERATION

The finished coned blank is then ready for hobbing. This is accomplished by placing the blank and the hardened hub in a special fixture or subpress so that the inverted hub (face) is in alignment with the center of the cone on the upright blank. The fixture is adjustable so that different diameter blanks and hubs can be made to register center over center. The fixture with blank and hub is then centered on the anvils of a hydraulic press (capacity 700 tons) and pressure is applied, approximately 50 tons for 10¢, 60 tons for 1¢ and 5¢, 70 tons for 25¢ and 90 tons for 50¢. This forces the face of the hub against the cone on the annealed blank causing it to take a negative impression from the positive design on the hub.

ANNEALING OPERATION

The blank has now become work hardened and resists further movement. To relieve this condition, the blank is annealed by packing in hardwood charcoal in nichrome cups and heating in an annealing furnace to 1425° F. soaking at this temperature for 4¼ to 4½ hours and then allowing to cool very slowly in the shutdown furnace. The annealed die is now carefully cleaned with a dilute solution of Hydrochloric Acid (1 part acid to 3 parts water), hot water and thoroughly scrubbed with pumice soap. The Hub is now carefully registered into the existing impression on the die and placed in the hydraulic press for a second blow (squeeze) using the same pressures as before. This procedure is repeated a third time for all U. S. Coins except the half dollar, which sometimes requires a fourth blow.

The die impression is now carefully examined to make sure complete, all over contact has been made with the design on the hub, that there are no doubles (failure to exactly register) and that it is clean with no foreign inclusions or impressions, scratches, etc.

TURNING OPERATION

The die is now fastened by the extreme lower end (base) in a 4-jaw chuck on an engine lathe and very carefully centered so that the inner edge of the border of the design runs true to center and the flat on the border runs 90° true to the axis. This is done by eye using magnification and a small pointer, accuracy to within .0001". After centering, the excess steel is turned off and the die is finished according to dimensions shown on submitted drawings in separate folder.

After turning the body of the die, it is placed in a 3-jaw chuck on an

engine lathe with the base in position for cutting off to the specified length using gauges.

After turning, a different number is assigned to each die and this is stamped directly on the shoulder of the soft die and a record is kept of these numbers.

Dies prepared for single press operation are now ready for hardening. Dies being prepared for dual operation are placed in a fixture on a milling machine and an accurate flat is milled into the base.

New die turning techniques are now being considered. One system uses a tracer lathe attachment and the other is a machine that turns three sizes on a die at once. The tracer lathe is unique in that all the operator has to do is load the piece and press a button and the lathe will take up to four rough cuts; one semi-finish cut, one finish cut and will return to ready position for the first roughing cut without any resetting by the operator. Another advantage to this attachment is that it can be fitted to any lathe, thus utilizing existing lathes. This machine is capable of enabling one man to turn 60 dies a day.

HARDENING OPERATION (WATER HARDENING STEEL)

The dies are hardened by again packing in hardwood charcoal in individual nichrome cups and placing in a hardening furnace. The temperature is brought up to 1475° and the dies are allowed to soak at this temperature about one hour per inch of die diameter.

The dies are then removed from the cups with tongs and placed face down in the correct hole in the quenching fixture. This consists of a large tank containing a pipe system and a nozzle 1½" diameter pointing upward. This

nozzle is oriented directly under a hole in the lid on the tank. Around this hole on the underside is a cylindrical baffle approximately 1½" deep x 3" in diameter to concentrate the water stream around the face and neck of the inverted die. An automatic device for mixing hot and cold water to a predetermined temperature and a quick opening valve are external parts of this quenching device.

At the instant the red hot die is inserted face down in the proper opening, the valve is opened manually and water preheated, from 70° to 76° F., under pressure, about 40 lbs. per square inch, is forced against the face of the die through the nozzle. To check the excess water from spraying around the clearance in the opening, an asbestos pad is held over the tongs and the base of the die. The die is held in this stream of water until it is cool enough to hold.

The dies are then cleaned on the face by scrubbing with a dilute solution of Hydrochloric Acid (1 part acid to 3 parts water) and pumice soap. The dies are then placed in a tempering furnace (Leeds & Northrup Homo) and kept at a constant temperature of 350° F. for 4¼ hours except for 1¢ dies which are kept at 400° for 4¼ hours.

They are then removed and tested for hardness and uniformity on a Rockwell Model 'TT' hardness tester, "C" Scale. Proper hardness has been established at between 59 and 61+ Rockwell "C".

Single dies and dual dies are given a final close inspection for nicks, dents, pits, scale, etc. and are then ready for setting in the coin presses.

<u>GRINDING OPERATION</u>

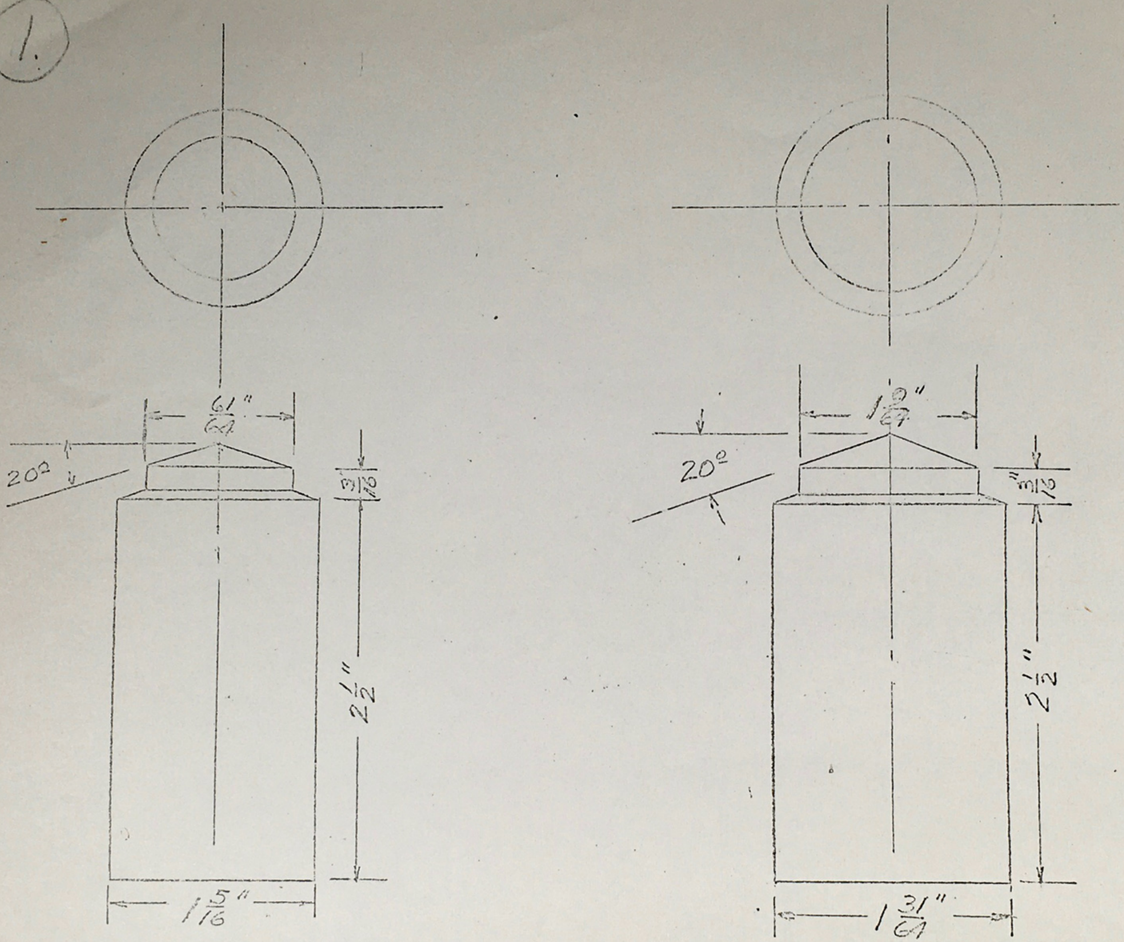
Dual dies are precision ground on the neck, the body, across the flats and across the base to exact dimensions so that they are interchangeable in

Philadelphia dual die holders.

After this precision grinding operation and final inspection, dual dies are then ready for delivery to the Coining Division for fitting in dual die holders and setting in the presses. All dies are inspected and packed in Philadelphia to be shipped to Denver and San Francisco Mints.

(The procedures of the manufacturing of dies have not been revised due to the fact of experimentation in the process. New equipment, new procedures, and new use of steel is under consideration for implementation into the New Philadelphia Mint, and in the future Mr. Gasparro will revise the explanation of die manufacturing.)

1.



DUAL BLANK
CENT-NICKEL & DIME

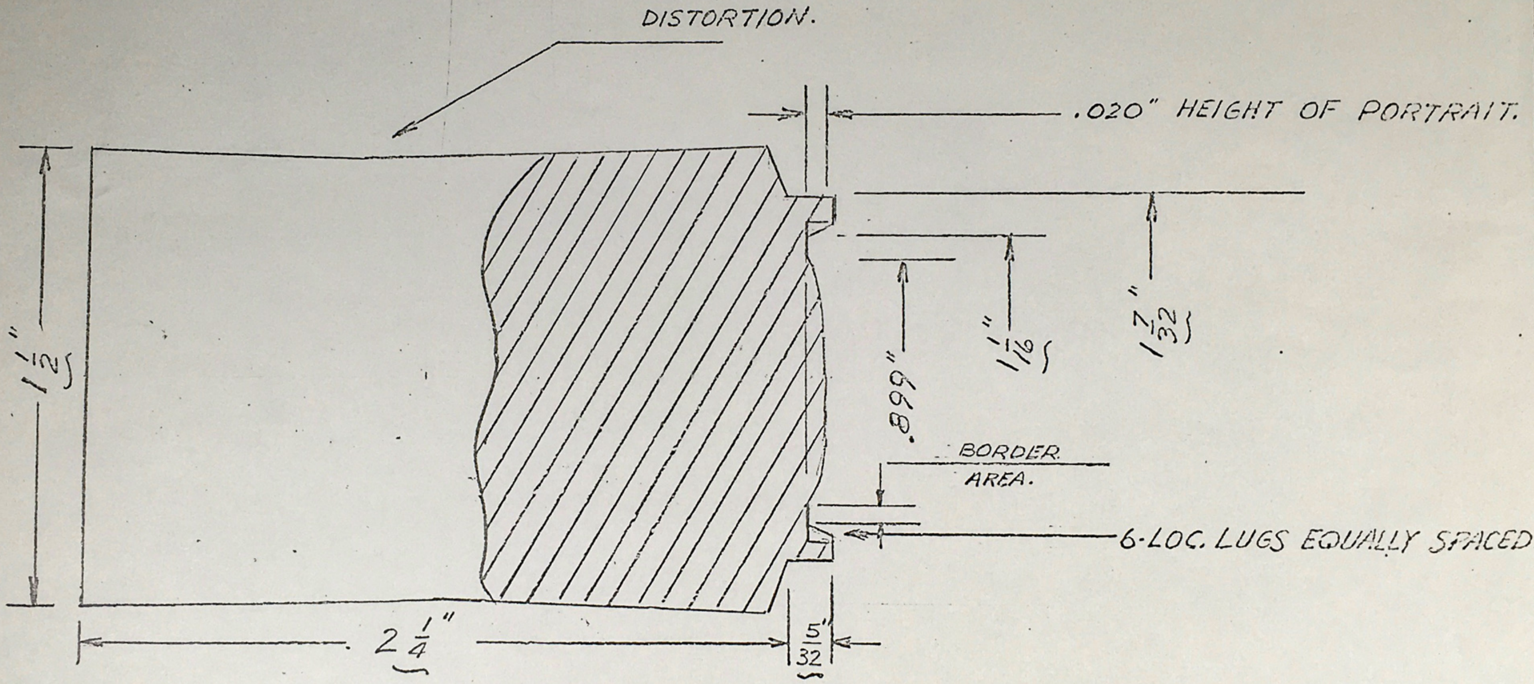
QUARTER DOLLAR

PRE-STRUCK-DIE BLANKS

TOLERANCES ON ALL FRACTIONAL DIMENSIONS ± 1/64"; ANGLES ± 1°

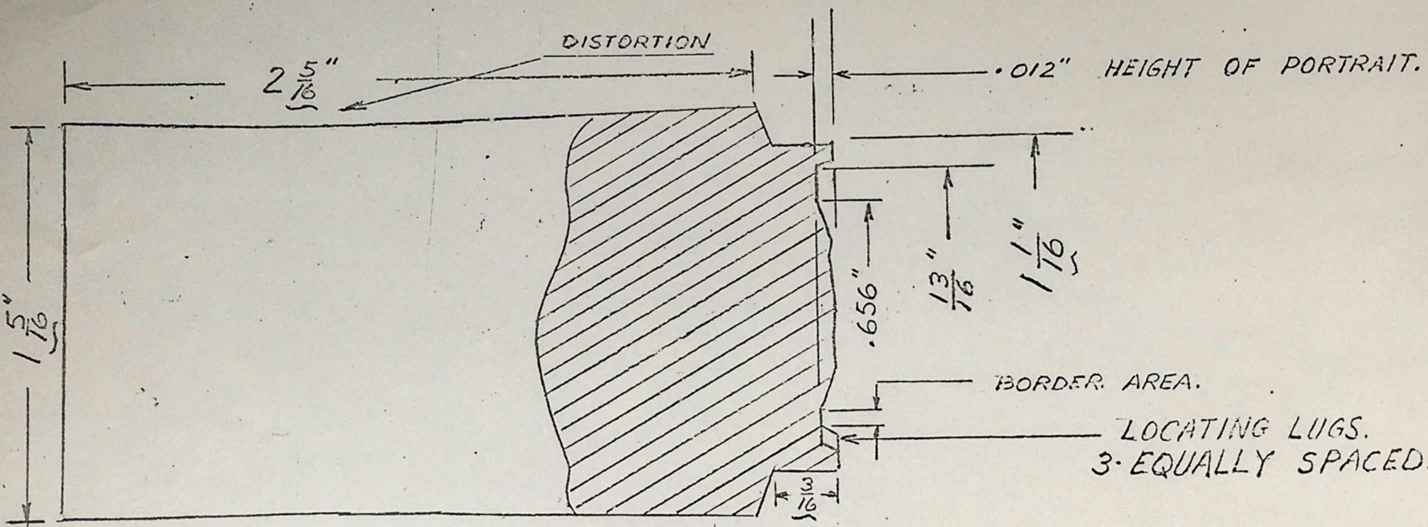
U.S. MINT - PHILA.	
DIE BLANKS	
SCALE:	FULL SIZE
DRWN: -	N. GIORDANO

7



FINAL STRIKE · QUARTER DOLLAR

U.S. MINT. - PHILA., PA.	
QUARTER DOL. BLANK.	
SCALE ·	2 : 1
DR'W'N BY ·	N. GIORDANO.



FINAL STRIKE DIME DUAL DIE BLANK.

U.S. MINT. PHILA.	
DIME DUAL BLANKS	
SCALE:	2 ÷ 1
DRW'N-	N. GIORDANO

A. B. Macellaro ABM

April 4, 1966

Analysis of Present Die Production
Capacity and Requirements for F.Y. 67

The detail data presented in this report was accumulated from the following sources:

(a.) Estimated coin production for the remaining fiscal year 66 and fiscal year 67, from Mr. S. Carwile.

(b.) Average coining die life, from reports sent to Bureau and discussions with Mr. D. Young.

(c.) Die production details, from Mr. F. Gasparro.

A. Accumulated Data:

1. Coining die production for F. Y. 66.

(a.) The estimated coin production for the remaining months of F.Y. 66, from March through June, inclusive, is 3,303,000.000 coins.

(b.) Dies required for estimated production, per denominations are as follows:

One Cent	-	1,328	dies
Five Cent	-	700	"
Dime Clad	-	20,181	"
Quarter Dollar (Clad)	-	12,868	"
Half Dollar (Silver)	-	5,618	"
Half Dollar (Silver Clad)	-	596	"
Approximate total of dies required	-	41,291	"

For estimated die production. See Data Sheet #1.

2014000
13
3014000
30

2. Coining die production for F.Y. 67.

(a.) Estimated coin production is 13,008,000,000.

(b.) Dies required for estimated production per denominations are as follows:

One Cent	-	4,216	dies
Five Cent	-	4,332	"
Dime (Clad)	-	70,588	"
Quarter Dollard (Clad)	-	21,669	"
Half Dollar (Clad)	-	6,084	"
Approximate total dies required	-	106,889	"

For estimated die production. See Data sheet #2.

3. Coining die production for Special Mint Sets (F.Y.66).

(a.) Estimated Mint Set production 4,000,000.

(b.) Dies required for estimated production per denominations are as follows:

One Cent	-	160	dies
Five Cent	-	228	"
Dime (Clad)	-	532	"
Quarter Dollar (Clad)	-	532	"
Half Dollar (Clad)	-	132	"
Approximate total dies required	-	1,584	"

For estimated die production. See Data sheet #3.

4. Coining die production for Special Mint Sets (F.Y. 67).

   (a.) Estimated Mint Set production 8,000,000.

   (b.) Dies required for estimated production per denomination are as follows:

One Cent	-	320	dies
Five Cent	-	456	"
Dime (Clad)	-	1,064	"
Quarter Dollar (Clad)	-	1,064	"
Half Dollar (Clad)	-	264	"
Approximate total dies required	-	3,168	"

For estimated die production. See Data sheet #3.

5. Available equipment and manpower in engraving department (Die Shop).

   1. Seventy-five men. Twenty-five/shift.

   2. Equipment

      (a.) 18 conventional lathes

      (b.) 3 cylindrical grinders

      (c.) 2 surface grinders

      (d.) 7 hardening furnaces

      (e.) 4 annealing furnaces

      (f.) 1 conomatic lathe

      (g.) 1 turret lathe

      (h.) 2 hubbing presses

6. The maximum utilization of available equipment and capacity based on a production rate of 2,116 dies/wk. (1965)

The following results are based on a time study submitted by Mr. Gasparro. See sheet #4.

Operations	Die Prod. Rate/21 hr.	Die Prod./week
Conomatic	600	3,000
Disc Grind #1	600	3,000
Disc Grind #2	600	3,000
Hubbing #1	630	3,150
Annealing	600	3,000
Hubbing #2	600	3,000
Turning - 7 Lathes	441	2,205
Machining Base - 3 Lathes	756 duals	3,780
Inspection and Cleaning (2 men)	504	2,520
Die Hardening (7) Furnaces 25 Dies/furnace 175 Dies/3 hours (2 shifts) Quenching	700	3,500
Tempering (1) shift (4) Furnaces	560	2,800
Grinding Duals and Singles	252	1,260

7. Manpower required to produce 2,116 dies per week.

Operations		Total Manpower/3 shifts
1.	Conomatic	1
2.	Disc Grinding #1	1
3.	Disc Grinding #2	1
4.	Hubbing #1	6
5.	Annealing	6
6.	Hubbing #2	6
7.	Turning Lathes	21
8.	Base Machining	9
9.	Inspection and Cleaning	6
10.	Die Hardening	4 (2 shifts)
11.	Quenching	4 (2 shifts)
12.	Tempering	2 (1 shift)
13.	Grinding (Philadelphia only)	6
	Total	73 men

In view of the above results no additional manpower is required.

8. Estimated production increase, by DeVlieg method:

Method Operations	Estimated Time in Minutes
Center Drilling	1
Rough Turning	1½
Finish Turning	2½
Total time	5 minutes

In view of the above results, the DeVlieg operation will produce one die every 5 minutes.

Estimated die turning production for a 7 hour production/shift.

Operation	Dies/hr.	Dies/shift	Dies/3 shift	80% efficient Dies/week
Center Drilling	60	420	1,260	5,040
Rough Turning	40	280	840	3,840
Finish Turning	24	168	504	2,016

Based on the above results no additional equipment is needed with the exception of another turning lathe.

DIE PRODUCTION FOR F.Y. 66

DENOMINATIONS	PRODUCTION ESTIMATE FOR MARCH & JUNE	AVERAGE LIFE OF OBVERSE DIES (STRIKES)	AVERAGE OBVERSE LIFE	AVERAGE LIFE OF REVERSE DIES (STRIKES)	AVERAGE REVERSE LIFE	AVERAGE LIFE OF REVERSE & OBVERSE DIES	TOTAL DIES REQUIRED
1¢	756×10^6	1,007,653(P) 1,330,000(D)	$1,168 \times 10^3$	1,044,207(P) 1,173,752(D)	1108×10^3	1,138,000	1328
5¢	97×10^6	319,000 (P) 216,000(D)	267,000	324 000 (P) 251,000 (D)	287,540	277,000	709
CLAD 10¢	1.904×10^6	191,476 (P)	181,476	181,563(P)	181,563	? 187,000	20,181
CLAD 25¢	978×10^6	178,000 (P) 134,144(D)	156,072	176 000 (P) 121,000(D)	148,500	152,286	12,868
CLAD 50¢	53×10^6	13 192,000(D)	192,200	162,000 (D)	162,800	177,500	596
SILVER 50¢	15×10^6	626 561 ~~62,656~~ (P) 339 344 ~~50,340~~ (D)	~~56,500~~	470,043 ~~47,043~~ (P) 473 824 ~~53,536~~ (D)	50,289	~~53,394~~	~~[illegible]~~
						APROX. TOTAL DIES	35,673

DIE PRODUCTION FOR F.Y. 67

DENOMINATIONS	COIN PRODUCTION ESTIMATE F.Y. 67	AVERAGE LIFE OF OBVERSE & REVERSE DIES (STRIKES)	TOTAL NO OF DIES REQ'D
1¢	2400×10^6	1,138,000	4,216
5¢	700×10^6	277,000	5054
10¢	6600×10^6	187,000	70,588
25¢	3300×10^6	152,286	21,669
50¢	108×10^6	177,500	6084
		APPROX. TOTAL DIES	107,61[illegible]

SHEET #2

SPECIAL MINT SET; DIE PRODUCTION F.Y. 66 & 67

DENOMINATIONS	PRODUCTION ESTIMATE FOR F.Y 66 MAR. TO JUNE	PRODUCTION ESTIMATE FOR F.Y 67	AVERAGE LIFE OF OBVERSE & REVERSE	TOTAL NO OF DIES REQ'D F.Y. 66	TOTAL NO OF DIES REQ'D F.Y. 67
1¢	4,000,000	8,000,000	50,000 STRIKES	160	320
5¢	"	"	35,000	228	456
10¢	"	"	15,000	532	1064
25¢	"	"	15,000	532	1064
50¢	"	"	60,000	132	264
			APPROX. TOTAL DIES	1584	3168

SHEET #3

PRESENT DIE OPERATIONAL DATA

TIME STUDY.

OPERATIONS REQUIRED IN MANUFACTURING OF DIES	NO. OF PIECES PRODUCED 24 HRS.	OPERATIONAL TIME IN (MINUTES) FOR SINGLE DIES		OPERATIONAL TIME IN MINUTES FOR DUAL DIES		
		25¢	50¢	1¢	5¢	10¢
CONOMATIC BLANKS	600	-	-	-	-	-
CLEANING.	600	-	-	-	-	-
GRINDING #1 CONE OF BLANK	600	2 1/2	→			
GRINDING #2 CONE OF BLANK	600	2 1/2.	→			
HUBBING (FIRST BLOW)	270	4	→			
ANNEALING (AVERAGE)	270	3	→			
HUBBING. (SECOND BLOW)	270	4	→			
TURNING. OPER. (BODY)	270	15	15	17	→	
MACHINING BASE OF DIE	270	5.	→			
INSPECTION & CLEANING.	270	5	→			
HARDEN DIES (HEATING)	270	5	→			
QUENCHING	270	4.	→			
TEMPERING	270	3.	→			
GRINDING FLATS DUALS.	45 DUALS	-	-	8 .10	→	
GRINDING. BODY (DUALS)	45 DUALS	-	-	9 15	→	
FINAL INSPECTION	270	5	→			
TOTAL TIME REQ'D TO PRODUCE ONE DIE		56 MIN	56 MIN	76 MIN	76 MIN	76 MI[N]

ENGRAVING DEPARTMENT

TO PREPARE DIES

SINGLE DIES - 25¢, 50¢

February 13 to 26, 1966

Preparing blank
1. Conomatic
2. Cutting or butting
3. Grind using #320 rough disc
4. Grind using #400 finish disc

Enter 1st blow
Anneal die
Reenter 2nd blow
Turning
Cutting off back of die
Inspecting and cleaning
Harden
Quench
Homo-tempering
Final inspection

DUAL DIES - 1¢, 5¢, 10¢

Preparing blank
1. Conomatic
2. Cutting or butting
3. Grind using #320 rough disc
4. Grind using #400 finish disc

Enter 1st blow
Anneal die
Reenter 2nd blow
Turning
Cutting off back of die
Inspecting and cleaning
Harden
Quench
Homo-tempering
Milling flats
Grinding hardened dual die
Final inspection

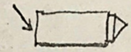
CONTINUED

TO PREPARE DIES

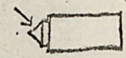
DUAL DIES 1¢ 5¢ 10¢

TIME REQUIRED

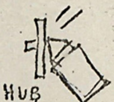
1. CONOMATIC LATHE (CONED BLANK) — 4 MIN.



2. CUTTING OR BUTTING (TRUING BACKS OF CONES ON LATHE) — 1 MIN.

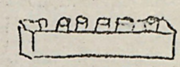


3. FINISHING TOP OF CONE BLANKS IN LATHE — 2 MIN.



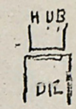
4. GRIND AND POLISH CONE WITH # 400 CLOTH BY HAND — 2 MIN.

5. ENTER FIRST BLOW — 3 MIN.



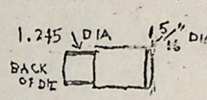
6. ANNEAL DIE (TO PACK FOR ANNEALING FURNACES) — 3 MIN.

THIS HEAT REQUIRES 24 HOURS EACH DIE

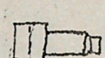


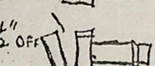
7. RE-ENTER SECOND BLOW — 3 MIN.

8. TURNING

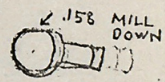


	OLD METHOD	"EE" LATHES NEW METHOD
(A) 1ST OPERATION (CENTERING UNIT)	3 MIN	1 MIN
(B) 2ND OPERATION (FINISHING)	17 MIN.	2.75 MIN





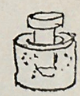
9. CUTTING OFF BACKS ON LATHE — .8 MIN.



9B MILL FLATS - PHILA. ONLY (DENVER DO THEIR OWN) (SF - DO " ") — .6 MIN.

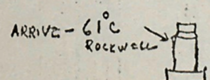
IN SOFT STATE - 4 AT ONE TIME

10 INSPECTION AND CLEAN — 4 MIN.

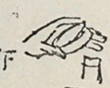


11 HARDEN DIE (HEAT TREATING 2½ HOUR EACH DIE) — 5 MIN. TO PREPARE

12. QUENCH BY WATER — 4 MIN.

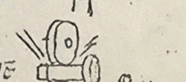


13. HOMO TEMPERING (4 HOURS) — 2 MIN

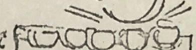


14. FINAL INSPECTION AND SHIP DUAL DIES TO DENVER AND SF — 4

FOR PHILA. ONLY



15. GRIND HARDENED DIE - CYLINDRICAL GRINDER - ONE AT TIME .008 TO .009 OFF — 8



16 GRIND FLATS - SURFACE GRINDER - .008 OFF - 5 DIES AT TIME — 9

17. FINAL CHECK AND DELIVER TO PHILA COINING DIVISION — 1

(OVER)

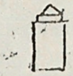
ENGRAVING

TO PREPARE DIES

SINGLE DIES - 25¢ - 50¢	TIME REQUIRED

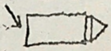
PREPARING BLANK

1. CONOMATIC LATHE (CONED BLANKS) 5 MIN.



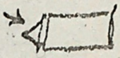
4 MIN.

2. CUTTING OR BUTTING (TRUING BACKS OF CONES ON LATHE) 5 MIN.



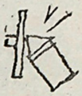
1 MIN.

3. FINISHING TOP OF CONE BLANK IN LATHE (B)



2 MIN.

4. GRIND AND POLISH CONE WITH #400 CLOTH BY HAND



2 MIN.

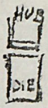
5. ENTER FIRST BLOW 4 MIN.

3 MIN.

6. ANNEAL DIE (TO PACK FOR ANNEALING FURNACES) — 3 MIN 3 MIN

(THIS HEAT REQUIRES 24 HOURS BACK DIE)

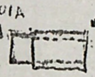
7 REENTER SECOND BLOW 4 MIN.



3 MIN

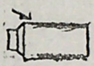
8. TURNING

1ST OPERATION



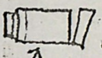
OLD METHOD 3 MIN — NEW METHOD 1 MIN.

2ND OPERATION (FINISHING)



17 MIN 2.75 MIN

9. CUTTING OFF BACKS ON LATHE



8 MIN.

10 INSPECTION AND CLEANING FINAL DIE 4 MIN.

11. HARDEN DIE (HEAT TREATING 2½ HOURS)

DIE" CUP OF CARBON

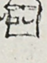
5 MIN.

12 QUENCH BY WATER AND CLEAN SCALING

4 MIN.

13. HOMO TEMPERING (4 HOURS)

TO ARRIVE



2 MIN TO PREPARE

14. FINAL INSPECTION

READY FOR DELIVERY

TO 3 MINTS

TIME REQUIRED 66 MINUTES OLD METHOD 49.75 MINUTES THROUG 'EE' METHOD

STEEL DIE BAR BREAKDOWN

Actual Weight of Finished (Lathe) Dies

50¢ Single - 16-1/2 oz.
25¢ Single - 13 oz.
1¢, 5¢, 10¢ Dual - 5-1/2 oz.

	Finished Length of Blank	Conomatic Excess cuts off Blank		Complete Blank Size	Weight of Bar	Length of Bar	Pieces	Excess Waste of Bar
		Front	Back					
1-5/8" Single 50¢	3-1/2"	1/16"	3/16"	3-3/4"	83 lbs.	11 ft.	35	8-1/2"
1-5/16" Dual 10¢, 5¢, 1¢	2-7/8"	1/16"	3/16"	3-1/4"	55 lbs.	11 ft.	44	10"
1-1/2" Single 25¢	3-3/16"	1/16"	3/16"	3-7/16"	72 lbs.	11 ft.	41	8"

Steel Bars on Rack (Vary in Length)

	Wt. of Blank
1-5/16" = 11' 10" average	19-1/4 oz.
1-1/2" = 11' 8" average	25-1/4 oz.
1-5/8" = 11' 8-1/2" average	35-2/3 oz.

W-1 STEEL

F. Gasparro 12/14/66

HEAT TREATMENT OF COINAGE DIES IN THE ENGRAVING DEPARTMENT

STEEL

W-1 Steel is equivalent to Air-Melt Carpenter II Vacuum or Air-Melt being used. Best electric furnace product--.96 to 1.05% carbon; shepard hardenability 8 to 10 on 3/4" round to 1450° F; water quench fracture grain size 9 or finer; annealed at 140-150 Brinnel maximum or Rockwell-B 87°; heat-treated, water quenched and hardened to Rockwell-C Scale 61.5°.

COINAGE DIE PROCESS

1. The coned blank is processed by the Conomatic 8-spindle turret lathe from 10' steel round bars 1-5/16" - 1-1/2" - 1-5/8" dia. preannealed 170 Brinnel maximum to sizes:
   Dual Blanks - 1-5/16" dia. x 2-7/8" height
   Single Blanks - 1-1/2" or 1-5/8" dia. x 3-1/4" height

2. The coned die blank is then polished with #320 and #400 disc grinding cloth.

3. The die blank is pressed or struck on the hydraulic press using the coinage hub to create the first impression (40 tons pressure).
   Hub hardness - 65.5 Rockwell-C 150-K
   Die Blank hardness - 140-150 Brinnel maximum - Rockwell-B 87°

4. Dies are annealed. Cycle of annealing: The blank has now become work hardened and resists further movement. To relieve this condition, the blank is annealed by packing in hardwood charcoal in nichrome pots 20 dies in each with face down, heated in annealing furnace to 1425° for 4-1/2 hours, then being allowed to cool slowly in a shut-down furnace overnight.

   Heat Control - Automatic temperature control panels -
   3 Leeds & Northrup Speedomax Panels
   1 Honeywell Panel

   Timing - Heat brought up to $\frac{1380°}{1400°}$ - 8 a.m. to 10 a.m.
   Dies are then packed and placed in furnace - 10 a.m.
   Heat shut-down - 4 p.m.
   Furnace doors open for cooling - 12 a.m.
   Die pots drawn out of annealing on rolling tray cart for cooling - 6 a.m.

5. Dies are then taken out of pots to cool, then scrubbed or cleaned by soft wire rotating brush - 9 a.m.

6. Dies are then struck (2nd blow). The hub is carefully registered into the existing impression on the die and placed in hydraulic press for 40 tons pressure -
   1¢, 5¢, 10¢ - 2 blows
   25¢, 50¢ - 3 blows

7. Die is carefully examined and surface cleaned.

8. Die Turning - Die is turned very carefully centered so that the inner edge of border of design runs true to center and the flat on border runs 90° true to axis - accuracy .0001.

9. Hardening - Dies are then prepared for hardening in hardwood charcoal in individual nichrome cups, die surface downward, and placed in gas Surface Combustion Furnace. The temperature is brought up to 1475°. This temperature climb takes 2 hours. Die is allowed to soak at this temperature at about 1 hour per inch. The die in the nichrome cup is kept in the furnace for 1-1/2 hours. 20 dies in nichrome cups can be heated in 1 gas furnace.

   Heat Control - Automatic temperature control panels -
   Old Room : 3 Leeds & Northrup Panels
   1 Honeywell Panel
   New Room : 3 Leeds & Northrup Speedomax H Panels

10. Quenching - The cup with the inserted die is taken out of furnace and placed on quenching panel board for 1 second. The die is removed from charcoal cup with tongs and placed face-down in the correct hole or die-sized aperture in the quenching fixture. This consists of a large tank containing a pipe system and a nozzle (1-1/2" dia.) pointing upward. This nozzle is oriented directly under a hole on the lid on the tank. Around this hole on the underside is a cylindrical baffle (1-1/2" deep x 3" in dia.) to concentrate the water stream around the face and neck of the inverted die. An automatic device for mixing hot and cold water to the temperature of 75° to 80° at 40 to 60 lbs. per square inch against the face of the die through the nozzle is the external part of this quenching device. To check the excess water from spraying around the clearance in the opening, an asbestos pad is held over the tongs and the base of the die. The die is held in this stream of water until it is cool enough to hold (1 minute per die). The die is checked for hardness--near the surface neck - 65°;
    at the bottom - 50-52° Rockwell C-Scale 150-K - (hardness explanation below).

11. Dies are placed in homo-tempering. (Leeds and Northrup Homo-Furnace) - Dies are kept in for constant temperature of 350° to 400° for 4-1/2 hrs.

    Heat Control - 4 Leeds & Northrup Speedomax Automatic Temperature Control Panels

12. Dies are taken out of Homo-Tempering Furnace.
    Check: <u>Rockwell Hardness</u> -
    Model TT Hardness Tester
    60° - 61° on the top of die around neck
    and 48° - 50° on bottom;
    3/32" - 1/8" depth of hardness penetration

13. This variance of hardness is created to produce a cushion of softness at the bottom of the die to relieve the constant pounding in coinage press. The surface top is required to hold a firm hardness.

14. The dies are cleaned on the face by scrubbing with diluted solution of hydrochloric acid (1 part acid to 3 parts water) and pumice soap. Also, we had success in cleaning the surface of dies by using a soft wire rotating brush. <u>It is required that no scaling is found on dies after hardening and quenching</u>.

15. The final operation required is for inspection of dies and surface cleaned, with a fine abrasive stick of #320 and #400 paper. Single dies are now ready for coin press. Dual dies require grinding of body and neck of dies to specified dimensions--grinding an average of .005 off; to a die tolerance of .0005 plus or minus.

PRESENT NUMBER AND CAPACITY OF FURNACES

<u>7 Heat-Treating Hardness Furnaces</u> -

<u>Old Area</u>
#1 - Surface Combustion Gas Furnace, 5' x 7', heats 20 dies every 2 hrs.-3 shifts
#2 - Surface Combustion Gas Furnace, 5' x 7', " " " " " " " "
#3 - Electric (box-type), 5' x 7', " " " " " " " "
#4 - Gas Furnace, Hevi-Duty, 5-1/2' x 7', " " " " " " " "

<u>New Area</u>
#5 - Surface Combustion Gas Furnace, heats 20 dies every 2 hrs. - 3 shifts
#6 - Surface Combustion Gas Furnace, " " " " " " " "
#7 - Surface Combustion Gas Furnace, " " " " " " " "

Our present requirements - 400 dies hardened daily

<u>4 Gas Annealing Furnaces</u>

3 - Big Furnaces - 6' x 8-1/2' anneal 220 dies each on a 24 hour cycle
1 - Surface Combustion Furnace - anneals 60 dies on a 24 hour cycle - 720 dies on 3 shifts

<u>4 Homo-Tempering Furnaces</u>

1 - Homo - 5 baskets @ 30 dies in each - 150 dies every 4 hours
4 - Homos - 1 shift = 1200 dies

HEAT TREATING FOR HARDENING

The limit of critical point of exposure in air of the die (before quenching) is 5 to 10 seconds from furnace. 5 seconds from cup to water (from the time the die in the nichrome cup is taken out of the furnace to the point where the die is inverted and quenched). Once the die is exposed and the heated die cools below 1350°, it loses its hardenability. In developing equipment possibly for multiple quenching, faster movement of trays holding dies from furnace to the quenching unit must be developed.

SINGLE AND DUAL DIE QUENCHED

Hardness Rockwell test--before tempering

Die neck at top	- 65-67°
Side of die (center)	- 59-61°
Bottom of die	- 54-57°

SINGLE AND DUAL DIE AFTER TEMPERING

Die neck at top	- 59-61°
Side of die (center)	- 55-57°
Bottom of die	- 49-51°

* * *

Descriptive literature of specifications on heat equipment in the Engraving Division is submitted herewith:

MATERIAL

Hardwood Charcoal - Cliffchar, Grade #2 - For charcoal gas generator, Charmo Gas Furnace
From: Cliffs Dow Chemical Company, Marquette, Michigan -or- Adams Coal, Phila., Pa.

" " Grade #10 and bone charcoal pulverized, #DC XX - For packing dies
From: Bell Industries, Phila., Pa.

Hydrocarbon Fluid - For Electric Furnace
From: Leeds and Northrup

MINOR SUPPLIES

Pure Lard	- To mix with bone charcoal in packing dies
Hydrochloric Acid	- For cleaning dies From: General Chemicals Phila., Pa.
Pumice Soap	- For cleaning dies
Soft Wire Rotating Brush	- " " "
Nichrome Cup and Boxes	- Custom-made From: Driver-Harris Harrison, N. J.
Alcohol	- Industrial

-oOo-

STANDARD FORM 33 DECEMBER 1964 EDITION GENERAL SERVICES ADMIN. FPR (41 CFR) 1-16.101	INVITATION, BID, AND AWARD (SUPPLY CONTRACT)	CONTRACT NO. ORDER NO. *(If any)*	PAGE NO. 1	NUMBER OF PAGES 4

ISSUED BY Michael H. Sura, Superintendent United States Mint	ADDRESS YOUR BID TO: Superintendent, U. S. Mint 16th & Spring Garden Streets Philadelphia, Pa. 19130
FOR INFORMATION CONTACT *(Name and number)* Mr. James J. Kelly, 597-4989	

INVITATION FOR BIDS

DATE ISSUED: October 19, 1966 — INVITATION NO.: 12

BIDS MUST BE SUBMITTED IN ORIGINAL AND 2 COPIES. — BIDS WILL BE OPENED — TIME: 2 P.M. E.S.T. — DATE: November 16, 1966

Sealed bids for furnishing the supplies or services described in the Schedule will be received in the designated bid opening room until the date and time specified above and at that time publicly opened. All bids are subject to the following:

1. The attached Bidding Instructions, Terms, and Conditions, ~~XXXXXXXXXXXXXXXX~~
2. The General Provisions, Standard Form 32, June 1964 edition, which is incorporated herein by reference.
3. The Schedule included below and/or attached hereto.
4. Such other provisions, representations, certifications, and specifications as are attached hereto or incorporated by reference in the Schedule.

DELIVERY F.O.B.: U. S. Mint, Phila. Pa.

SCHEDULE

ITEM NO.	SUPPLIES OR SERVICES	QUANTITY *(Number of units)*	UNIT	UNIT PRICE	AMOUNT
	VACUUM MELTED DIE STEEL IN THE FOLLOWING SIZES:				
1.	1-5/16" Round Bars - 10 - 12 ft.	50,000	lbs.		
2.	1-1/2" Round Bars - 10 - 12 ft.	115,000	lbs.		
3.	1-5/8" Round Bars - 10 - 12 ft.	15,000	lbs.		
	(CONTINUED ON PAGE 3 WHICH IS PART HEREOF)				

BID *(NOTE.—REVERSE MUST ALSO BE FULLY COMPLETED BY THE BIDDER)*

In compliance with the above, the undersigned offers and agrees, if this Bid be accepted within ______ calendar days *(60 calendar days unless a different period is inserted by the bidder)* from the date of opening, to furnish any or all of the items upon which prices are quoted, at the price set opposite each item, delivered at the designated point(s) within the time specified in the Schedule. Discounts will be allowed for prompt payment as follows:
~~XXXXXXXXXXXXXXXXXXXX~~ ______ %, 20 calendar days; ______ %, 30 calendar days; ______ % ______ calendar days.

NAME AND ADDRESS OF BIDDER *(Street, city, State and ZIP code. Type or print)*	SIGNATURE OF PERSON AUTHORIZED TO SIGN BID	DATE OF BID
	SIGNER'S NAME AND TITLE *(Type or print)*	
AREA CODE AND TELEPHONE NO.		

AWARD *(To be completed by the Government)*

ACCEPTED AS TO ITEMS NUMBERED	AMOUNT $	DATE OF AWARD: UNITED STATES OF AMERICA BY ______ *(Signature of Contracting Officer)*
SUBMIT INVOICE FOR PAYMENT TO		CONTRACTING OFFICER'S NAME *(Type or print)*
PAYMENT WILL BE MADE BY		ACCOUNTING AND APPROPRIATION DATA

Award will be made on this Form, or on Standard Form 26, or by other official written notice.

REPRESENTATIONS AND CERTIFICATIONS

The Bidder makes the following representations and certifications as part of his bid: *(Check or complete all appropriate boxes or blocks.)*

1. SMALL BUSINESS REPRESENTATION *(See par. 12 on SF 33-A)*

He ☐ is, ☐ is not, a small business concern. If bidder is a small business concern and is not the manufacturer of the supplies bid upon, he also represents that all supplies to be furnished hereunder ☐ will, ☐ will not, be manufactured or produced by a small business concern in the United States, its possessions, or Puerto Rico.

2. REGULAR DEALER-MANUFACTURER REPRESENTATION

He is a ☐ regular dealer in, ☐ manufacturer of, the supplies bid upon.

3. CONTINGENT FEE REPRESENTATION

(a) He ☐ has, ☐ has not, employed or retained any company or person *(other than a full-time, bona fide employee working solely for the bidder)* to solicit or secure this contract, and (b) he ☐ has, ☐ has not, paid or agreed to pay any company or person *(other than a full-time, bona fide employee working solely for the bidder)* any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract; and agrees to furnish information relating to (a) and (b) above as requested by the Contracting Officer. *(For interpretation of the representation, including the term "bona fide employee," see Code of Federal Regulations, Title 41, Subpart 1-1.5.)*

4. TYPE OF BUSINESS ORGANIZATION REPRESENTATION

He operates as an ☐ individual, ☐ partnership, ☐ corporation, incorporated in the State of ________________.

5. BIDDER AFFILIATION AND IDENTIFYING DATA. Each bidder shall complete (a), and (b) if applicable, and (c) below:

(a) He ☐ is, ☐ is not, owned or controlled by a parent company. *(See par. 13 on SF 33-A.)*
(b) If the bidder is owned or controlled by a parent company, he shall enter in the blocks below the name and main office address of the parent company:

NAME OF PARENT COMPANY	MAIN OFFICE ADDRESS

(c) Employer's Identification Number *(See par. 14 on SF 33-A)*

BIDDER'S E.I. NO.	PARENT COMPANY'S E.I. NO.

6. EQUAL OPPORTUNITY

He ☐ has, ☐ has not, participated in a previous contract or subcontract subject either to the Equal Opportunity Clause herein or the clause originally contained in section 301 of Executive Order No. 10925; that he ☐ has, ☐ has not, filed all required compliance reports; and that representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained prior to subcontract awards.

7. BUY AMERICAN CERTIFICATE

The bidder hereby certifies that each end product, except the end products listed below, is a domestic source end product *(As defined in the clause entitled "Buy American Act")*; and that components of unknown origin have been considered to have been mined, produced, or manufactured outside the United States.

EXCLUDED END PRODUCTS	COUNTRY OF ORIGIN

8. CERTIFICATION OF INDEPENDENT PRICE DETERMINATION *(See par. 15 on SF 33-A)*

(a) By submission of this bid, the bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, that in connection with this procurement:

(1) The prices in this bid have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

(2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly to any other bidder or to any competitor; and

(3) No attempt has been made or will be made by the bidder to induce any other person or firm to submit or not to submit a bid for the purpose of restricting competition.

(b) Each person signing this bid certifies that:

(1) He is the person in the bidder's organization responsible within that organization for the decision as to the prices being bid herein and that he has not participated, and will not participate, in any action contrary to (a) (1) through (a) (3) above; or

(2) (i) He is not the person in the bidder's organization responsible within that organization for the decision as to the prices being bid herein but that he has been authorized in writing to act as agent for the persons responsible for such decision in certifying that such persons have not participated, and will not participate, in any action contrary to (a) (1) through (a) (3) above, and as their agent does hereby so certify; and (ii) he has not participated, and will not participate, in any action contrary to (a) (1) through (a) (3) above.

NOTE.—Bids must set forth full, accurate, and complete information as required by this invitation for bids (including attachments). The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

★ U.S. GOVERNMENT PRINTING OFFICE : 1965 OF—755-150 (42-E)

STEEL, TOOL VACUUM MELTED QUALITY in the above stated size round diameters of bars, Plus .007", Minus .000", Length of bars, 10 ft. minimum to 12 ft. maximum. Vacuum Melted Tool Steel, Best Quality Vacuum Induction Furnace product; .96% to 1.05% carbon; Shepherd hardenability No. 8 to 10 on 3/4" round from 1450° F. waterquench; fracture grain size 9 or finer; structure 100% sphereoidized; anneal hardness 170 Brinell maximum; to be supplied fully annealed.

STEEL FINISH: All steel furnished under this invitation must conform to a maximum 50 Micro Inch ground finish on all sizes.

REQUIREMENT: Results of tests made by the Mint on samples of your Vacuum Melted Die Steel during the past two (2) years will be a factor in making award under this invitation. The results of production runs on die steel furnished by the present supplier or suppliers shall be viewed as valid tests.

DELIVERY: Deliveries are to be made in quantities as listed below. Please state best time of delivery as this may be a factor in awarding the contract.

DELIVERY

1-5/16"	April, 1967	all	
1-1/2"	January, April, June, 1967	(approx.) 1/3 each month	
1-5/8"	January, 1967	all	

SHIPPING INSTRUCTIONS: All shipments of steel under this bid must be delivered on an open Bed Trailer or Truck, covered with canvas or tarpaulin. Steel to be bundled in maximum bundles weight not to exceed 2000# per bundle. This is a MUST REQUIREMENT as the Mint is not in a position to handle bundles of larger sizes.

FIRM PRICE: Quotations submitted must be on a firm price basis in order to receive consideration. Price quoted must be inclusive of delivery to U. S. Mint, Phila. Pa.

GUARANTEE: In the event that any lot of steel supplied under order resulting from this invitation proves to be unsatisfactory in the opinion of the Superintendent of the U. S. Mint, Phila. Pa., the unprocessed remainder of such lot of steel shall be replaced by the supplier at no cost to the Government. In the event that the replacement lot proves unsatisfactory, the contract will be terminated in accordance with Section 11 of the "General Provisions."

GENERAL PROVISIONS: A copy of "General Provisions" on Standard Form 32 is attached and is made part hereof.

WALSH HEALY ACT: Contract stipulations pertaining to the Walsh Healy Act are also attached and made a part hereof.

EQUAL EMPLOYMENT OPPORTUNITY: Section 301 of Executive Order No. 10925, dated March 6, 1961, (26 F. R. 1977) Nondiscrimination in Employment, and Title VII of the Civil Rights Act of 1964, Executive Order No. 11246, and the Plans for Progress Program are pertinent and applicable. Employer Information Report EEO-1 on Standard Form 100 is attached and made a part hereof.

TAX EXEMPTION: This certifies that the U. S. Mint, a Federal Agency, is exempt from the provisions of the Pennsylvania Selective Sales and Use Tax Act, (Act of 3/6/56, No. 381, Article 1, Sec. 2g).

DOMESTIC MATERIAL AND MANUFACTURE: Successful bidder must furnish a notorized statement of domestic material and manufacture under the terms of this bid. Location of plant, manufacturing the product and any technical literature on the hardening and annealing of the product furnished as standard practice.

____

NAME OF BIDDER

AMENDMENT #1 TO INVITATION #12
PARAGRAPH #1, PAGE 3

Paragraph #1 is changed to read as follows:

STEEL, TOOL VACUUM MELTED QUALITY in the above stated size round diameters of bars, Plus .007", Minus .000", Length of bars, 10 ft. minimum to 12 ft. maximum. Vacuum Melted tool steel, Best Quality Vacuum Induction Furnace product, or Consumable Vacuum Melting Process; .96% to 1.05% carbon; Shepherd hardenability No. 8 to 10 on 3/4" round from 1450^{o} F. waterquench; fracture grain size 9 or finer; structure 100% sphereoidized; anneal hardness 170 Brinell maximum; to be supplied fully annealed.

3 L
sura
F. Gasparro
H. L. Ainsworth

STEEL TOOL VACUUM MELTED in the above stated size round diameters of bars, Plus .007, Minus .000, Length of bars, 10 to 12 ft. Maximum. Vacuum Melted Tool Steel, Best Quality Vacuum Induction Furnace product; 96% to 1.05% carbon; shepard hardenability 8 to 10 on 3/4" round from 1450° F. waterquench; fracture grain size 9 or finer; structure 100% sphereoidized; anneal hardness 170 Brinnel maximum; to be supplied fully annealed.

STEEL FINISH: All steel furnished under this invitation must conform to a maximum 50 Micro Inch ground finish on all sizes.

REQUIREMENT: Results of tests made by the Mint on samples of your Vacuum Melted Die Steel during the past two (2) years will be a factor in making award under this invitation. The results of production runs on die steel furnished by the present supplier or suppliers shall be viewed as valid tests.

DELIVERY: Deliveries are to be made in quantities of _______ of the total amount of each item under this bid on a quarterly basis. Please state best time of delivery as this may be a factor in awarding the contract.

DELIVERY

1-5/16	_______	_______	_______	_______
1-1/2	_______	_______	_______	_______
1-5/8	_______	_______	_______	_______

SHIPPING INSTRUCTIONS: All shipments of steel under this bid must be delivered on an open Bed Trailer or Truck, covered with canvas or tarpaulin. Steel to be bundled in maximum bundles weight not to exceed 2000# per bundle. This is a MUST REQUIREMENT as the Mint is not in a position to handle bundles of larger sizes.

FIRM PRICE: Quotations submitted must be on a firm price basis in order to receive consideration. Price quoted must be inclusive of delivery to U. S. Mint, Phila. Pa.

GUARANTEE: In the event that any lot of steel supplied under order resulting from this invitation proves to be unsatisfactory in the opinion of the Superintendent of the U. S. Mint, Phila. Pa., the unprocessed remainder of such lot of steel shall be replaced by the supplier at no cost to the Government. In the event that the replacement lot proves unsatisfactory, the contract will be terminated in accordance with Section 11 of the "General Provisions."

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TAX EXEMPTION: This certifies that the U. S. Mint, a Federal Agency, is exempt from the provisions of the Pennsylvania Selective Sales and Use Tax Act, (Act of 3/6/56, No. 381, Article 1, Sec. 2g.)

DOMESTIC MATERIAL AND MANUFACTURE: Successful bidder must furnish a notorized statement of domestic material and manufacture under the terms of this bid. Location of plant, manufacturing the product and any technical literature on the hardening and annealing of the product furnished as standard practice.

____

NAME OF BIDDER

6 November 1967

MEMORANDUM OF VISIT TO THE U. S. MINT

A. E. Beck and E. Chung meeting with Mr. Frank Gasparro, Chief Engraver

Basic Method of Producing Medals and Coins

1. Drawing - The design is made in a line drawing and this is shaded to indicate low relief. From this a large plaster mold is used to produce a plaster original at larger scale, say between 6" to 10" in diameter. This medallion is slightly dished in the center and carefully leveled around the edges or perfectly flat. Part of the design may be filled in the middle of this plaque with wax or plaster to indicate a head, eagle, etc., in low relief.

2. An impression is made by pouring fine plaster over the original plaque.

3. This negative plaque is then cleaned up in detail and another impression is made.

4. This impression is now the same as the original and is gone over carefully by craftsmen with small tools to remove any blemishes.

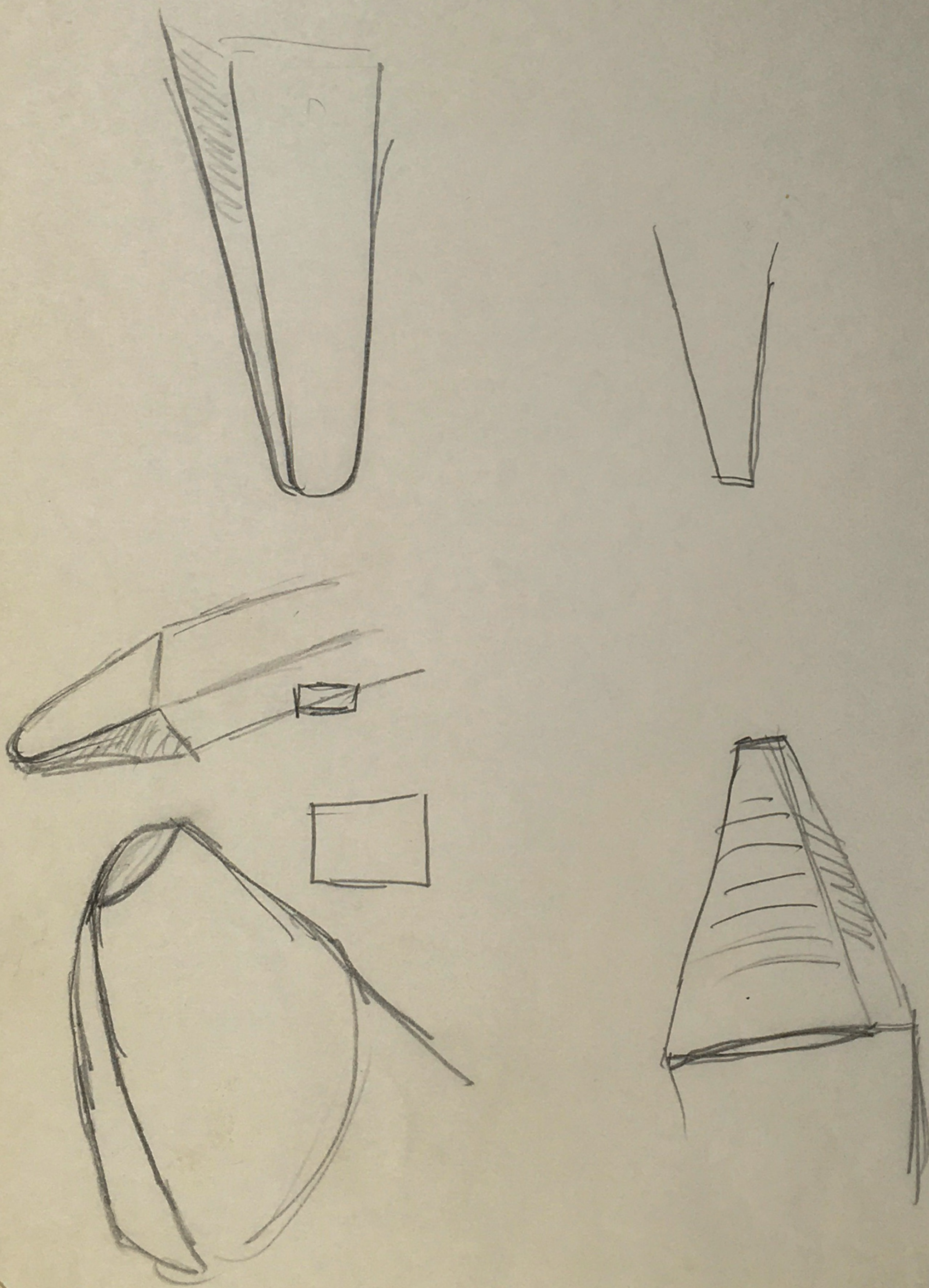
5. A negative mold is then prepared from this positive.

6. A galvano is formed on plaque number five. It is soaked with hot bees wax to size the surface of the plaster and is then placed in a galvanizing bath of copper solution. After the proper immersion time the plaque is removed from the bath, the plaster is carefully removed from the thin metal coating and the resulting galvano is carefully examined by the Chief Engraver for any imperfections or necessary corrections. The galvano is then backed up on the reverse side with another application of plaster and set on the reducing plate, and is now ready for reduction.

7. The final process in forming the master hub is to mount the positive galvano on the pantograph reduction machine where, by proportionate reduction over a continuous period of 36 hours, the large original model is reduced down to a very small reproduction on the hard metal forming the master hub.

Processing of Hubs and Dies

The die blanks which form the working dies are rough turned from round bar stock of soft metal. Impressions are then made by hardened hubs into soft steel blanks in three separate press operations. Between each of the pressings the struck die blanks are sent back to an annealing furnace for tempering. When the third and final press from the master hubs is obtained the dies are machined and hardened--water hardened or air hardened.



OPTIONAL FORM NO. 10
5010-103

UNITED STATES GOVERNMENT

Memorandum

cc MR CAMPBELL

TO : Mr. Sura DATE: November 14, 1963

FROM : Mr. Roberts

SUBJECT: Visit to Balfour, Mr. Gasparro

Submitted herewith is a copy of Mr. Gasparro's report on his trip November 13th to L. G. Balfour Company, Attleboro, Mass.

With reference to the invitation extended by the Balfour Company to have two of our die maker personnel spend a day or two at their plant to learn this process, it is suggested that Mr. Mackiewicz and Mr. Dalessio be assigned to this project.

cc: Mr. Campbell

F.
MR. Gasparro report ON HIS VISIT To L.G. BALFOUR Co

November 13, 1963

Mr. Gilroy Roberts
Chief Engraver and Sculptor
U.S. Mint
Philadelphia, Pa.

Attention: Mr. Michael H. Sura
Superintendent

Dear Mr. Roberts:

The U.S. Mint officials - Mr. Frederick W. Tate, Philip B. Neisser, Mr. Engel and myself, visited the L. G. Balfour Co., Attleboro, Mass., on Wednesday, November 13, 1963. The purpose of this visit was to make a study of their hubbing processes.

We OBSERVED ~~have come across~~ their method of hubbing AND BELIEVE IT ~~that~~ will prove most useful in our process of making medal dies and hubs and Post Office embossing dies. SEE ATTACHED DESCRIPTION,

The Mint has been extended an invitation by the officials of the Balfour Co. headed by Mr. C. Robert Yeager, President, to send two tool and die makers from the Die Shop Engraving Department to spend a few days to study and work in this process of die sinking - (using Balfour Co. dies) - so that in returning to the Mint they may apply this formula if possible in making hubs or dies.

Mr. Tate requests that Mr. Roberts, if he so desires, and if convenient, name two men from the Die Shop so that Mr. Yeager can be contacted and the necessary arrangements be made.

Frank Gasparro

November 13, 1963

L. G. Balfour Company, Attleboro, Mass.

The process of hubbing and sinking dies at the above plant is as follows:

A. Adjust hardened medal hub in place (hub 3" d.), in center of hubbing press (preferably hydraulic press) then adjust piece of soft steel (round or square shape) 3" d. flat, not coned, over hub to proceed to make die.

B. Come down and press 20 tons to make first impression. Repeat this pressure twice - the impression is therefore made deeper.

C. Brush over this unfinished die with black asphalt or photo resistant. This is called etching resistant. Let it stand 2 minutes.

D. Place hub over the asphalt or etching resistant brushed die.

E. Press 20 tons.

F. Take out die from hub. You will observe that spots that were not touched by the hub still show the black etching resistant still intace. Place the die on a hot plate at (finger) heat. Apply nitric acid with dropper. It will attack easily. Let this penetrate to .005 or .010 in depth depending on depth of relief. Then wash off die with water. You will see deeper penetration; however, the etching resistant is intact.

G. Press the hub again - 20 tons - into this unfinished die. Take out. This time the depth of penetration in die is deeper. The black etching resistant still shows where hub spots did not touch die.

H. Repeat - put die on hot plate, apply nitric acid with dropper, wash die off with water, then put hub and die under press, apply 20 tons.

I. Take out die - full impression should show - black etching resistant completely pressed out.

J. This operation at Balfour Co. was performed with a high relief medal hub and die - inside diameter of medal die 2" - within 20 minutes.

K. If the medal die has great depth of relief a heat annealing of one hour would be required to relieve the hubbing strain in the steel. Then let cool. Repeat application of etching resistant with nitric acid and continue until die is completely up in detail. Completed die should be brought up in one-half day with this process.

Therefore, where a die requires 6 to 7 days to complete due to our annealing in die sinking process, this process in all took approximately one-half hour from beginning - plain blank - to finished struck die.

After the above process the die can be put on a lathe to be turned and trimmed to size.

The steel used was from Houghton & Co. (MYA) Bethlehem Steel in block size 3" x 3".

Mr. Ken McGrath, Chief Metallurgist, will send us shortly the etching resistant and the name of the firm supplying their etching materials.

Frank Gasparro

TREASURY DEPARTMENT

UNITED STATES MINT SERVICE

PHILADELPHIA 30, PA.

OFFICE OF THE SUPERINTENDENT
UNITED STATES MINT

November 14, 1963

Mr. C. Robert Yeager
L. G. Balfour Company
Attleboro, Massachusetts

Dear Mr. Yeager:

Mr. Gasparro has informed me of the many courtesies and friendly reception accorded him and the other Mint officials on their recent visit to your company.

He was much impressed by the many up to date methods and efficient procedures that you have adopted in the operation of your plant and in particular your acid etch method of sinking deep relief hubs and dies.

I regret that it was inopportune, at this time, for me to be there. However, I wish to extend my sincere thanks for your kind invitation and for the beautiful gift you sent.

We are seriously considering your offer to have one or two of our die makers spend a day or two at your company to learn your acid etch method and will let you know in the near future.

Again, many thanks and kind regards.

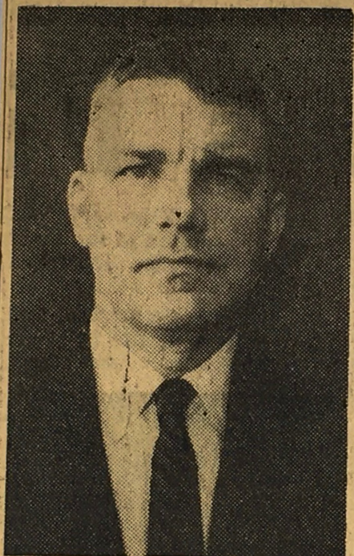
Sincerely yours,

Gilroy Roberts
Head, Engraving Division

Local Man

Continued from Page 1

a residence and studio in Talmadge Hill, have been active on committees for the New Canaan Outdoor Show, the Stamford Festival of Arts and the Silvermine Guild of Artists.



EDGAR Z. STEEVER

They also have taught classes in sculpture, pottery and crafts.

Mrs. Steever is known for her teaching of crafts and the decorative arts at the Stamford Girls' Club and last fall was head of the art workshop put on by the Professional Association of the Girls' Club of America at Bristol.

Mr. Steever has taught at the Silvermine Guild, the Westport Woman's Club and in the Darien adult education program.

Trained At Yale

A member of the National Sculpture Society, the National Arts Club and the Silvermine Guild of Artists, Mr. Steever received his training at Yale University and its School of Fine Arts.

His commissioned work includes bronze portrait reliefs at Yale University, Johns Hopkins, Columbia Presbyterian Medical Center, University of Bridgeport, Deefield Academy and CIO-AFL Headquarters in Washington, D.C.

While profiles, reliefs, busts and medals constitute the major portion of his work, he has completed several animals, notably a monumental leopard for Lafayette College at Easton, Pa.

ADVERT

) HEAVEN"

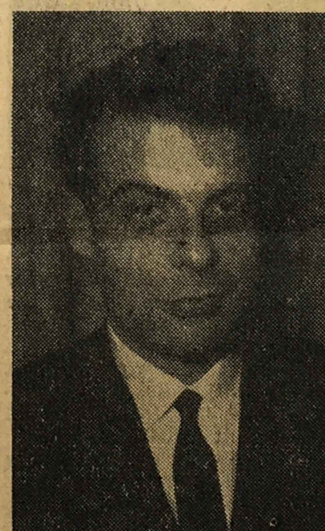
MAY 20, 1965

ol Staff

sts Fi

ing World War 2 he served as a second lieutenant in the Field Artillery in the European Theatre.

Mr. Schneid is a member and past president of the New Canaan Education Association.



STEPHEN E. RUBIN

Please turn to Page 2

Local Man Mint Sculptor

Edgar Zell Steever of New Canaan has been appointed sculptor-medalist to the United States Mint.

Noted for his sculptured head reliefs and statues and particularly for medals, medallions and portrait reliefs, he will be employed in the engraving division of the mint in Philadelphia, Pa.

His principal duties will include designing and excuting medals and comemorative reliefs for the Treasury Department and other government agencies.

The Steevers, who maintain

Please turn to Page 2

ort and Bett

WESTIN

June 9, 1965.

Dear Mr. and Mrs. Gasparro,

This is very late and I am sorry but last week I drove up to Cornell to get Ted. He had a heavey cold which I got plus finishing up work at the Girls club.

The very lovely dinner you gave us, touched me very much. It certainly was above and beyond the call of duty. I really felt a warm and friendly welcome. I hope it is the beginning of a fine and lasting

association and friendship.

Ed has probably told you we have found a lovely place. I ordered the moving van to-day and bought a second hand ice box from a man who was going to Australia.

We will be moving on the 16 of August which will be pretty wonderful. Ed seems extremly happy with this new job and I guess the quicker we get settled the better it will be for his work. I understand you have been very busy and I wish you all the best of luck.

Thank you both again for making me feel so much at home. The more I see of Phila the better I like it. I know this is Ed's big chance and I know he has very fine people to work with! Thank you again for all you have done. I shall never forget the phone calls and the real interest you have put into it.

Hope to see you all soon again

Sincerely

Velona Steever

MR. C. ROBERT YEAGER
PRESIDENT
L. G. BALFOUR Co
ATTLEBORO, MASS.

To...

IMPORTANT

Fill in the following information

City..

ORDER NUMBER ....

NAME OF ORGANIZATION ....

SUBJECT Hub and Die Etching Process

Refer to previous correspondence with (names)..

The etching technique for <u>dies</u> is carried out as follows: -

1. Paint die black with etching wax.

2. Drive hub into die on small press (percussion type press recommended.)

3. Repeat (2) wiping hub face clean of wax after each drive until hub comes out of die clean.

4. Heat die on hot plate until it can just be handled.

5. Add etching acid and remove when action ceases.

6. Wash die free of acid in water and remove all surplus wax with kerosene. Blow off die dry and dirt free.

7. Repeat (1) through (6) until detail in die approaches detail in hub, then start finishing procedure.

8. Finishing accomplished by using a <u>cold</u> die and a timed etch, decreasing etching time after each drive. A typical cycle of 3, 2, and 1 minute timed etch is suggested.

<u>Etching Wax Formula</u>: -

3 parts roofing pitch (hard)	(12 oz.)
3 parts benzine	(12 oz.)
3 parts savasol #5	(12 oz.)

It may require some searching to locate a brand of pitch with best properties as a stop-off wax.

Savasol #5----From the ~~XXXXXXXXXX~~. Socony Mobil Oil Co. Inc. New York, N.Y. U.S.A. or Paulsboro Refinery. Paulsboro, New Jersey. U.S.A. -

Etching Acid

Roughing Acid

1 Part Conc Nitric Acid C. P.
2 Parts Distilled Water.

Smoothing Acid (Best all around etch)

Solution A -
5 parts conc. nitric acid C. P.
1 part silver metal
5 parts distilled water

Solution B -
5 parts conc. nitric acid C.P.
1 part mercury metal
5 parts distilled water

Dissolve metals in quantity of acid indicated. Then add Solution A and Solution B to following mix in proportions indicated: -

1 Part Solution A
1 Part Solution B
4 Parts Conc. Nitric Acid C. P.
8 Parts Distilled Water   10 PARTS WATER ETCHES SMOOTHER

Respectfully submitted,

Al Love

Al Love

AL:N

Camera Visits Philadelphia Mint

Money Manufacture Unique Subject For Bulletin Lens

The week of February 10, 1963, was historic in the annals of the Philadelphia Mint!

February 13 key Mint officials, headed by Miss Eva Adams, the director, joined 14 citizens of the United States to make a yearly check of the coins of the nation.

On Sunday, February 10, Philadelphia's The Sunday Bulletin Magazine, edited by B. A. Bergman, launched the important week with a two-page color-black-and-white feature devoted to operations at the Mint.

Text of the feature was by Hans Knight with photographs by Russ Hamilton.

Philadelphians learned that mint employees "are the most honest people around," according to Superintendent Michael H. Sura.

Sura described security checks to Writer Hans Knight—he said all Mint employees are checked by the Secret Service and at odd times during the coinage operations, Secret Service men make spot checks through slots in the workshop walls. (Theft of a cent means instant dismissal.)

Superintendent Sura, according to the Bulletin story, said accuracy is all-important. He described scales that can weigh a human hair. Each day's output of coins is weighed and counted in specially designed machines and scales. Even a missing dime would register. Sura said the machines which count faster than the eye can see may make one mistake in a million.

Sura told the Bulletin writer that nothing is wasted. Workers shake out their overalls. Metal shavings are carefully swept up.

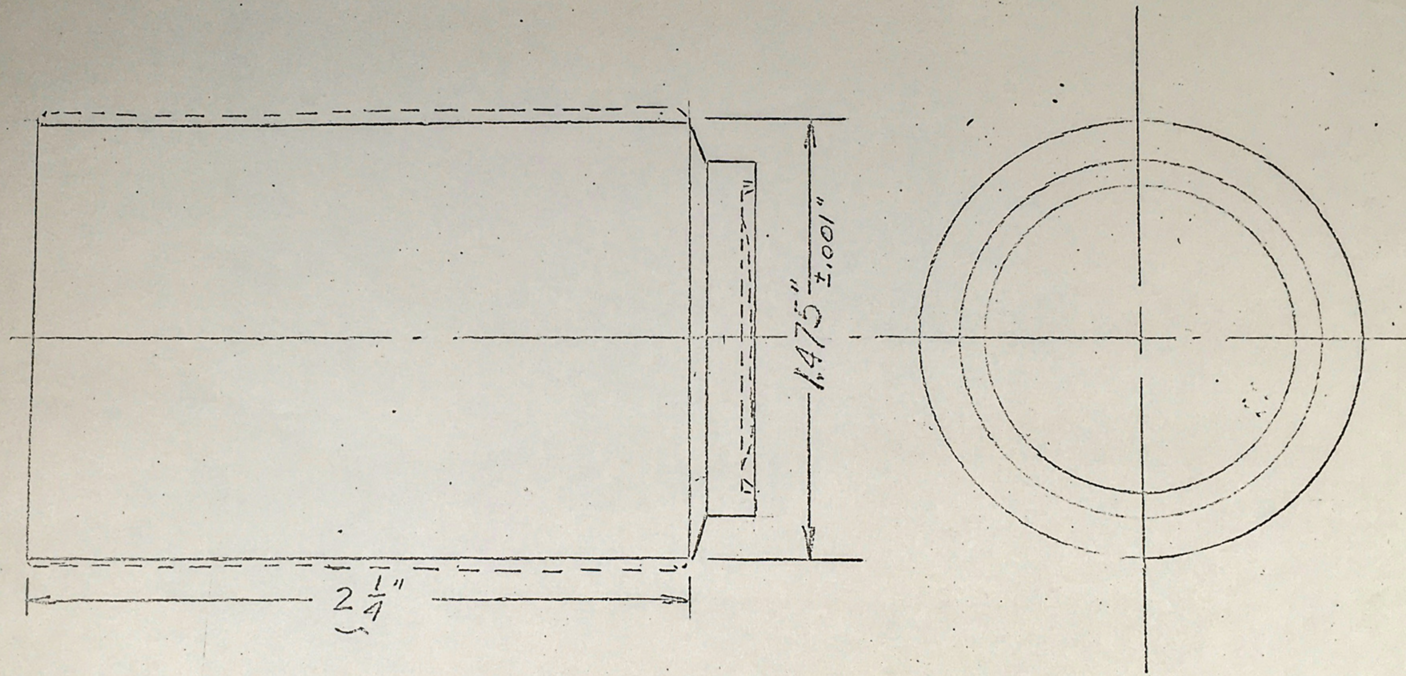
The Mint superintendent, a graduate of University of Pennsylvania's Wharton School (B. S. in economics) was a department store executive and later Philadelphia's city procurement commissioner. He was named to the Mint post in 1961.

In discussing his current commodity—money, Sura said the Mint works two shifts 75 per cent of the time and three shifts the rest.

Frank Gasparro, who designed the Lincoln Memorial reverse of the current cent, famous name in numismatic circles as one of the noted 20th century engravers at the Philadelphia Mint, checks the design for the Kennedy inaugural medal.


DIRECTOR
U.S. MINT
Our New Mint is a dream come true -
Here's hoping your dreams all come true, too!
Season's Greetings
Eva Adams

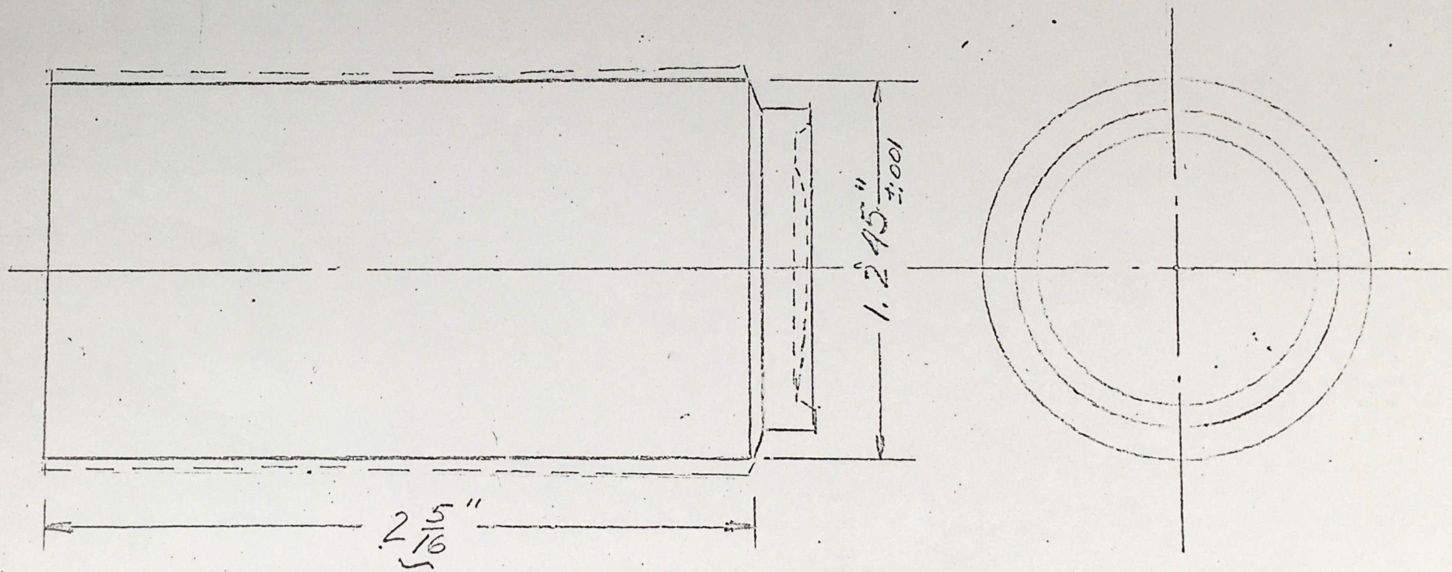
8
A



U.S. QUARTER DOLLAR - 1ST OPERATION
(TURN- 1.475" DIA.)

U.S. MINT. - PHILA., PA.	
DIE PROCESSING	
SCALE·	2÷1

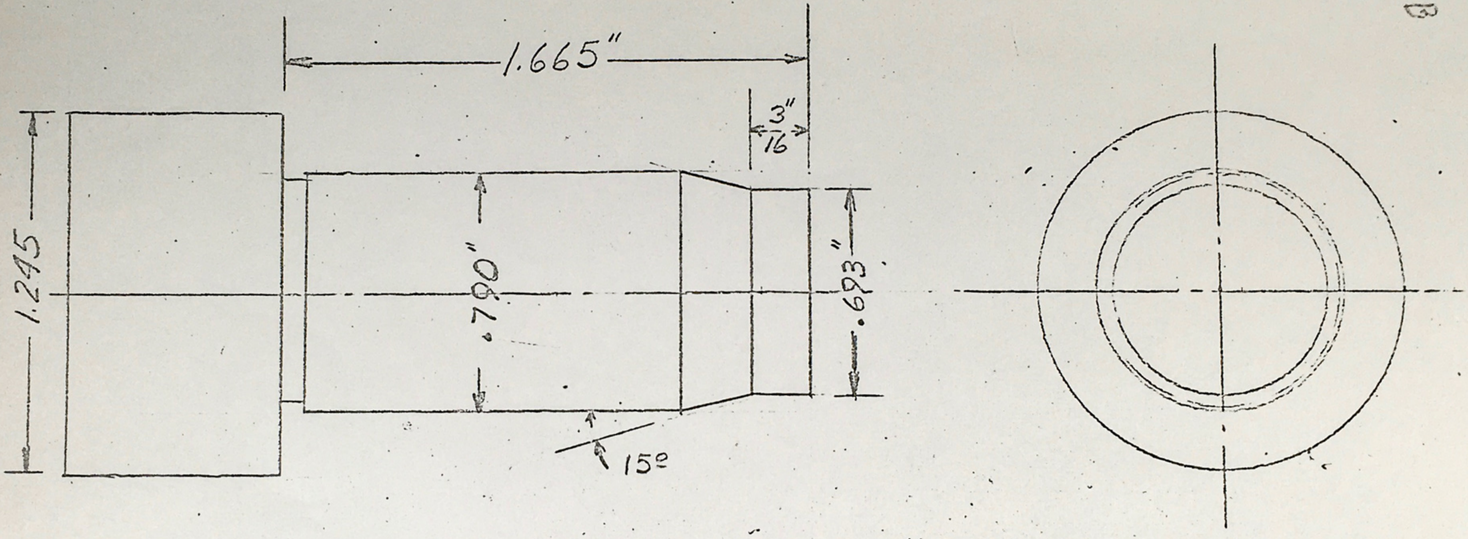
8
A



U.S. DIME DUAL 1ST OPERATION
(TURN 1.245" DIA.)

U.S. MINT. - PHILA., PA.	
DIE PROCESSING	
SCALE ·	2 ÷ 1
DR'W'N BY -	M. GIORDANO.

8

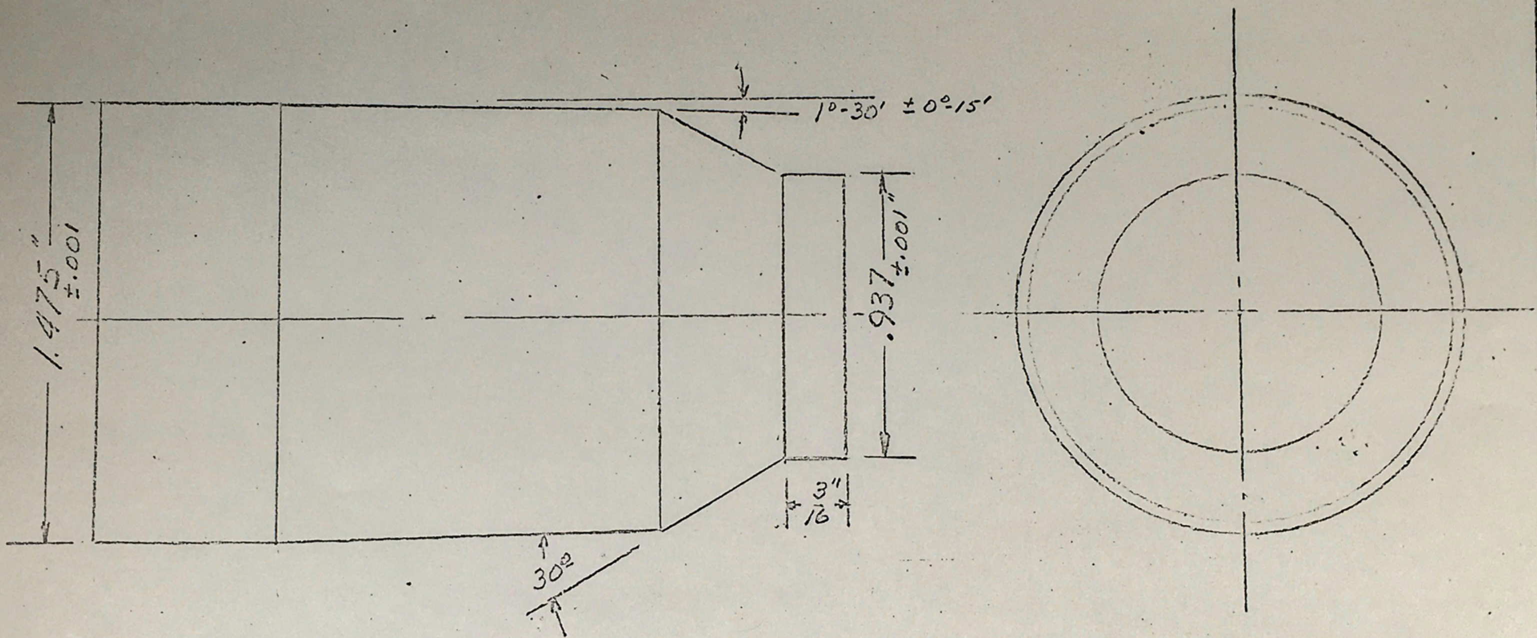


DIME DUAL (OBV.) 2ND TURNING OPERATION

TOLERANCES: FRACTIONAL DIMENSIONS ±1/64"; DECIMAL ±.001; ANGLES ±1°

US. MINT. - PHILA., PA.	
DIE PROCESSING	
SCALE.	2÷1
DRWN BY.	N. GIORDANO

8
B



QUARTER DOLLAR (OBV.) 2ND TURNING OPERATION.

TOLERANCES:- FRACTIONAL DIM. ± 1/64"; DECIMAL DIM. ±.001"; ANGLES ±1° UNLESS OTHERWISE SPECIFIED.

U.S. MINT. - PHILA., PA.	
DIE PROCESSING	
SCALE.	2÷1
DR'WN BY -	N. GIORDANO

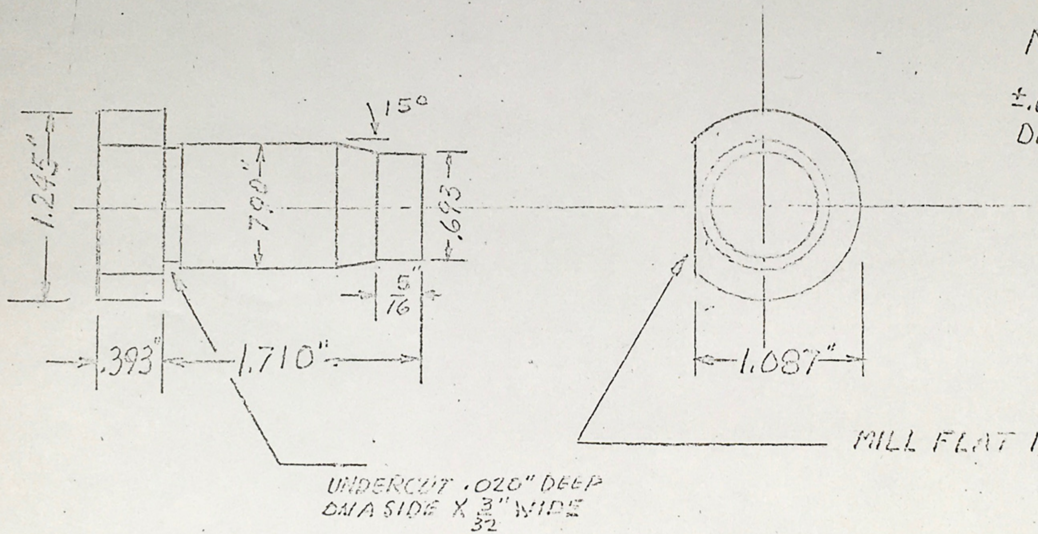
PHILADELPHIA

REVERSE

MILLING & TURNING DIMENSIONS

DIME DUAL

8 A. & B
9 A & B



MILL FLAT IN ACCORDANCE WITH GUA.

NOTE

±.001" TOLERANCE ON ALL DECIMAL DIMENSIONS.

U.S. MINT. - PHILA., PA.	
DUAL DIE	
SCALE.	FULL SIZE.
DRAWN BY -	N. GIORDANO

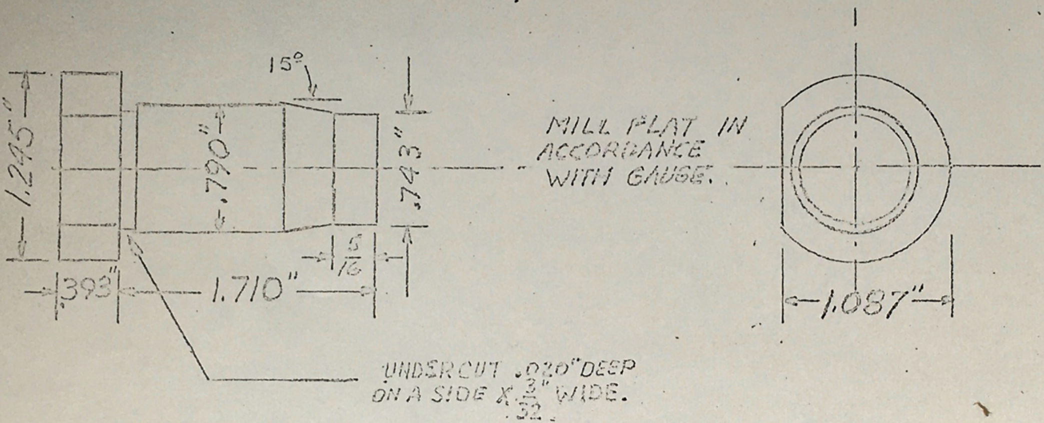
PHILADELPHIA

REVERSE

MILLING & TURNING DIMENSIONS

ONE CENT DUAL

8 A&B
9 A&B



NOTE:
±.001" TOLERANCE ON ALL DECIMAL DIMENSIONS.

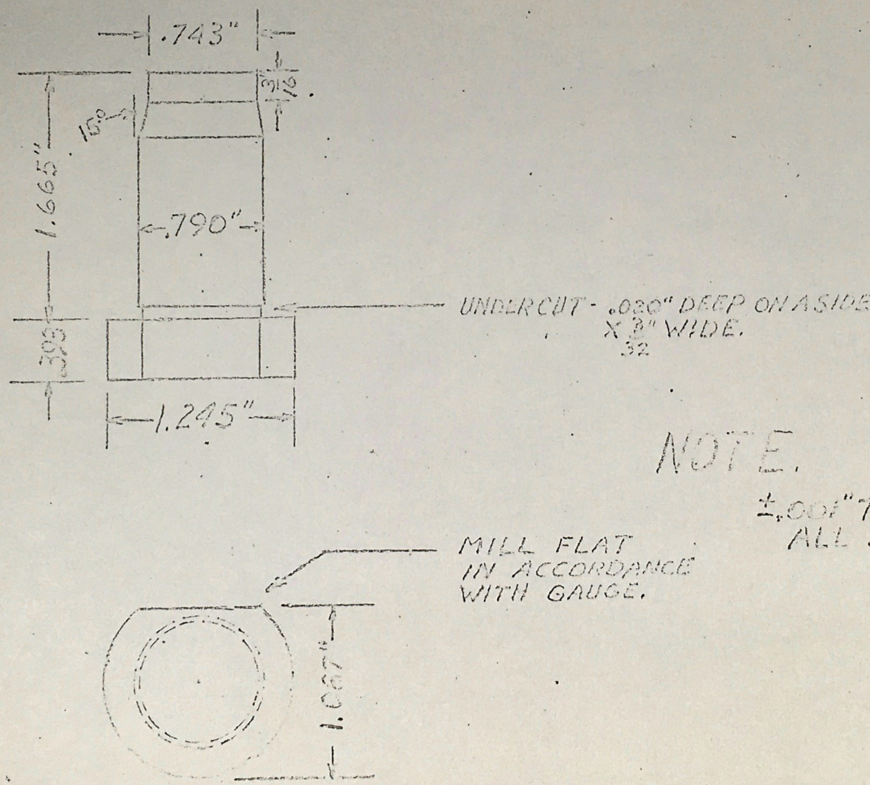
U.S. MINT.- PHILA., PA.	
DUAL DIE	
SCALE.	FULL SIZE.
DR'WN BY-	V. GIORDANO

9A&B
9A&B

PHILADELPHIA

OBVERSE

MILLING & TURNING DIMENSIONS
ONE CENT DUAL



NOTE.

±.001" TOLERANCE ON ALL DECIMAL DIMENSIONS.

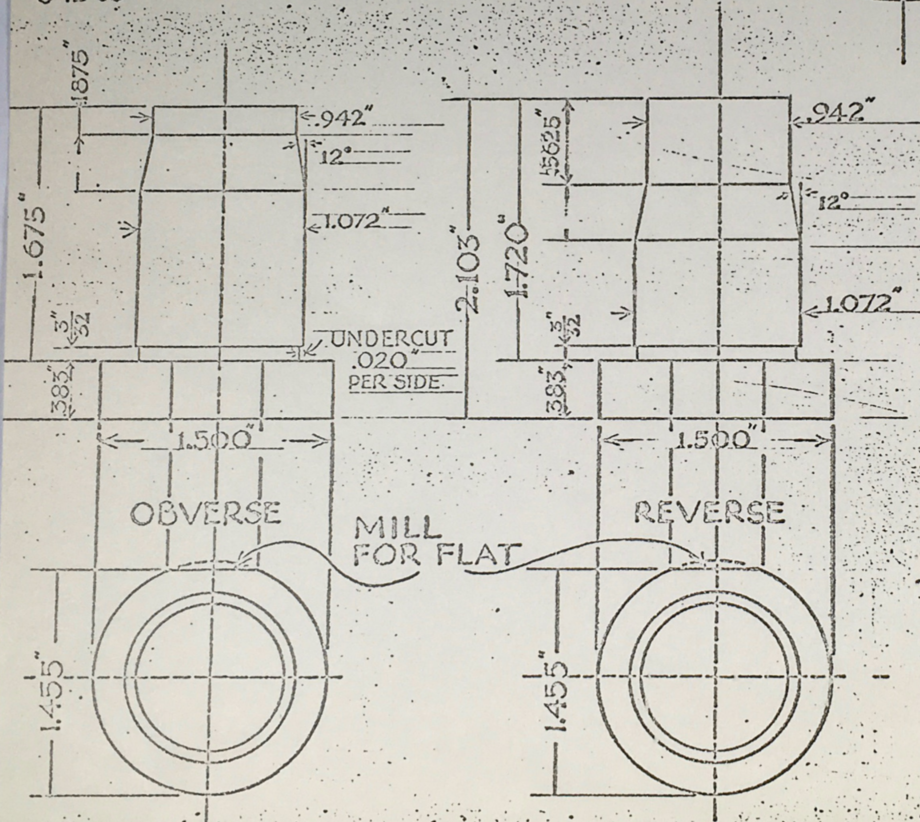
U.S. MINT. - PHILA., PA.	
DUAL DIE	
SCALE.	FULL SIZE
DRWN BY.	N. GIORDANO

8A2B
9A&B

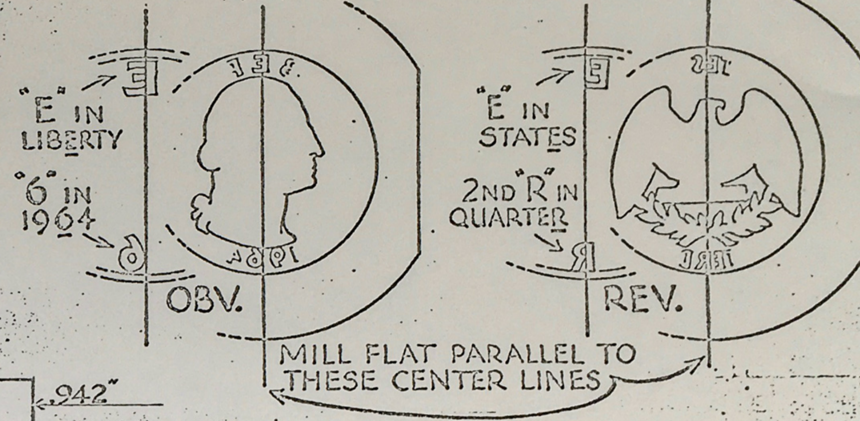
U. S.
QUARTER-DOLLAR DUAL DIES

TURNING & MILLING SIZES

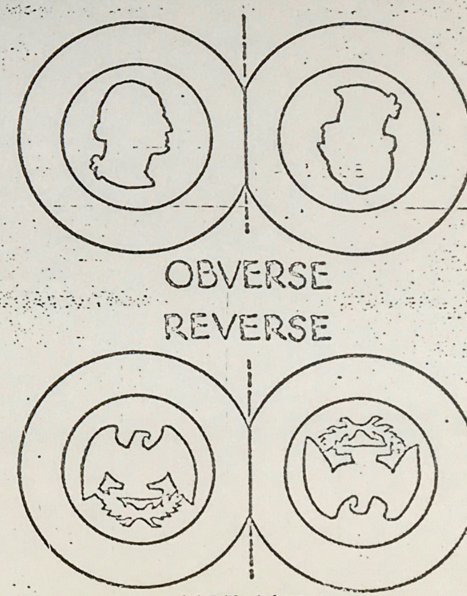
UNITED STATES MINT, PHILADELPHIA, PA.
DESIGNED & DRAWN BY S. D'ALESSIO & E. GROVE
8·12·65



VERTICAL ALIGNMENT



DUAL ALIGNMENT



USE NEW
QUARTER-DOLLAR GAUGE

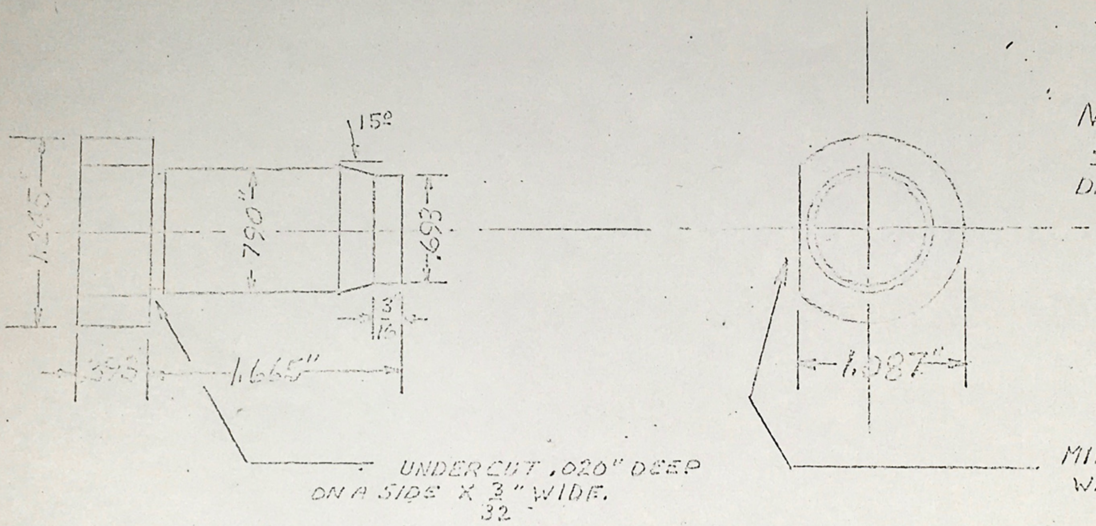
PHILADELPHIA

OBVERSE

8 A&B
9 A&B

MILLING & TURNING DIMENSIONS

DIME DUAL

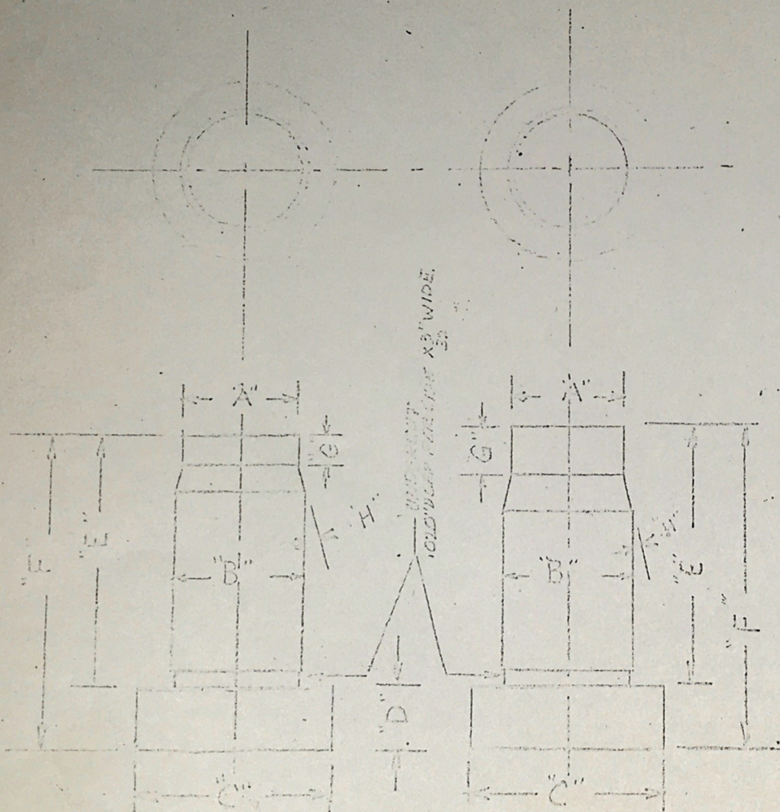


NOTE
±.001" TOLERANCE ON ALL DECIMAL DIMENSIONS.

U.S. MINT. - PHILA., PA.	
DUAL DIE	
SCALE:	FULL SIZE.
DR'N BY:	[illegible]

8 A&B

DENVER DUAL DIES — TURNING DIMENSIONS



OBVERSE REVERSE

OBVERSE DIE DIMENSIONS								
DENOMINATION	A	B	C	D	E	F	G	H
ONE CENT	.743	.790	1.260	.393	1.665	2.059	3/16	15°
NICKEL	.828	.945	1.260	.383	1.675	2.058	3/16	9°
DIME	.693	.790	1.260	.393	1.665	2.058	3/16	15°
QUARTER	.942	1.072	1.500	.383	1.675	2.065	3/16	12°

REVERSE DIE DIMENSIONS								
DENOMINATION	A	B	C	D	E	F	G	H
ONE CENT	.743	.790	1.260	.393	1.710	2.103	5/16	15°
NICKEL	.828	.945	1.260	.383	1.720	2.103	9/16	9°
DIME	.693	.790	1.260	.393	1.710	2.103	[illegible]/16	15°
QUARTER	.942	1.072	1.500	.383	1.720	2.110	9/16	12°

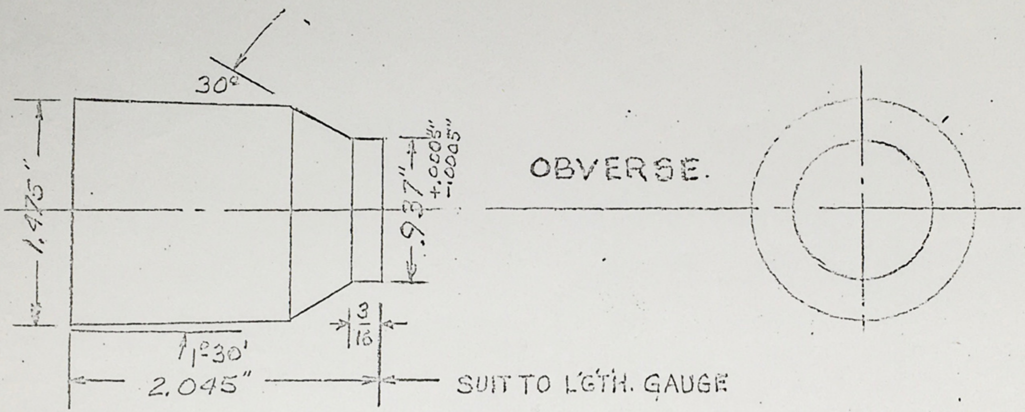
NOTE

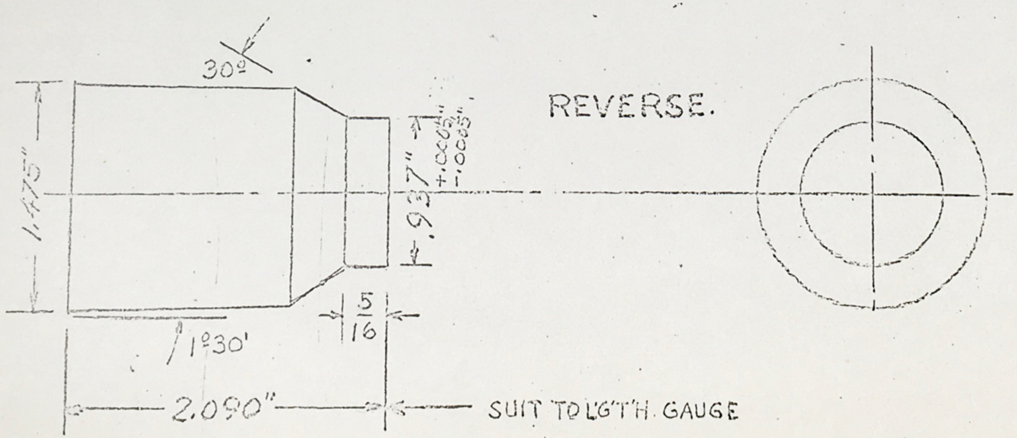
TOLERANCE ON ALL DECIMAL DIMENSIONS ±.001 FRACTIONAL ±1/64", ANGLES ±1/2°, UNLESS OTHERWISE SPECIFIED.

U.S. MINT. - PHILA., PA.	
DENVER DUAL DIES	
SCALE ·	

PHILADELPHIA QUARTER DOLLAR SINGLE DIE - TURNING DIMENSIONS

8A2B

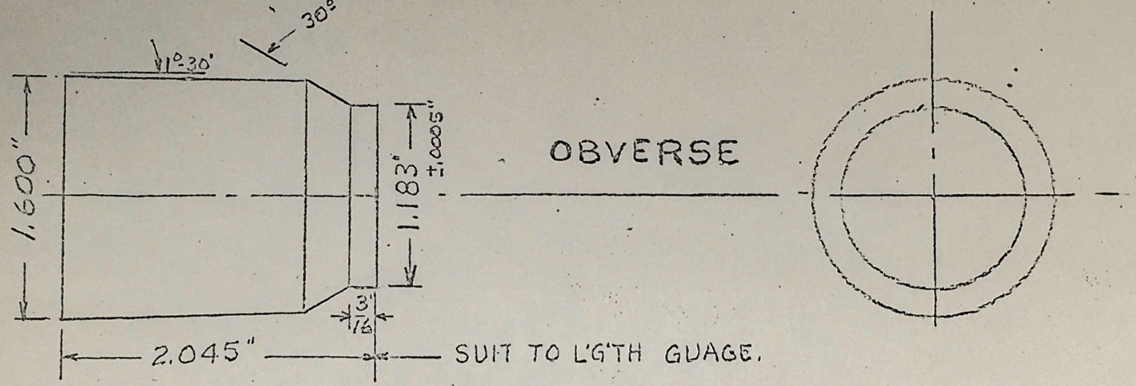


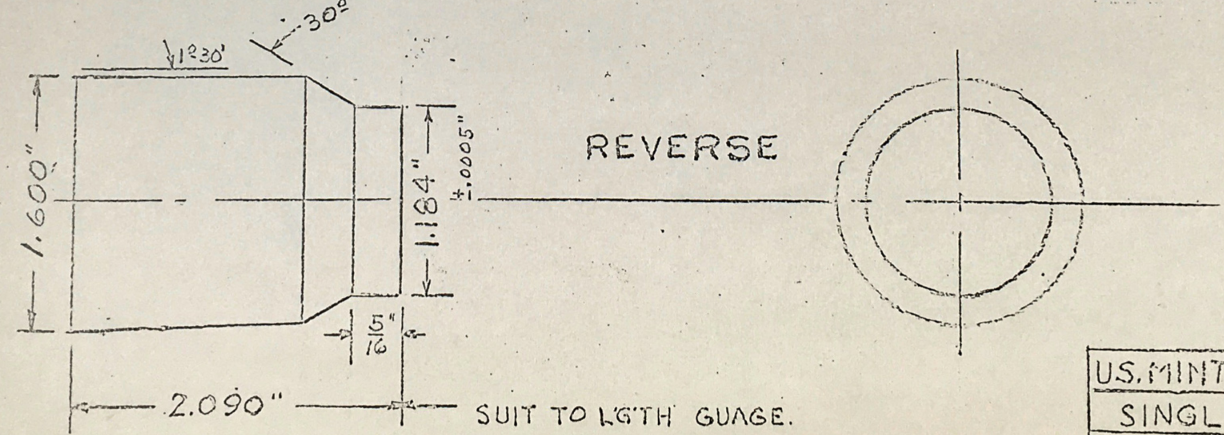


U.S. MINT. - PHILA., PA.	
SINGLE DIE	
SCALE ·	FULL SIZE.
DR'WN BY -	N. GIORDANO

PHILADELPHIA HALF DOLLAR SINGLE DIE. - TURNING DIMENSIONS. -

8A.&B.





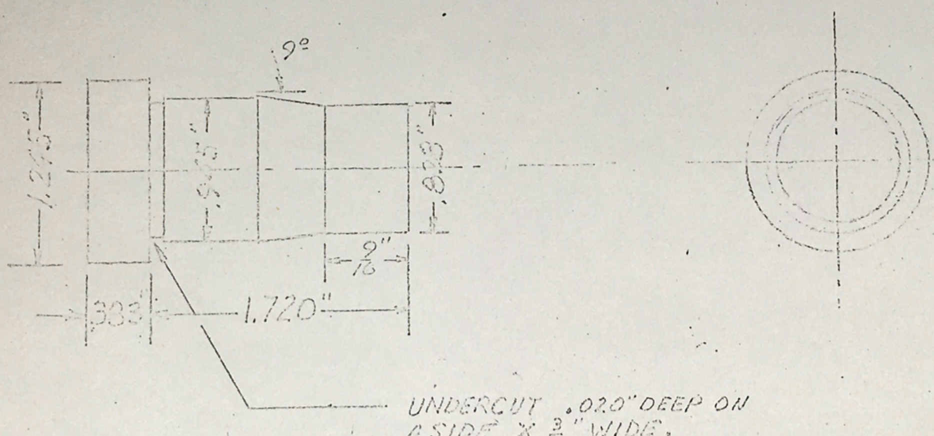
U.S. MINT. - PHILA., PA.	
SINGLE DIE	
SCALE.	FULL SIZE.
DR'W'N BY -	N. GIORDANO.

PHILADELPHIA

REVERSE

TURNING DIMENSIONS
NICKEL DUAL

8 A&B
9 A.



NOTE
±.001" TOLERANCE ON ALL
DECIMAL DIMENSIONS.

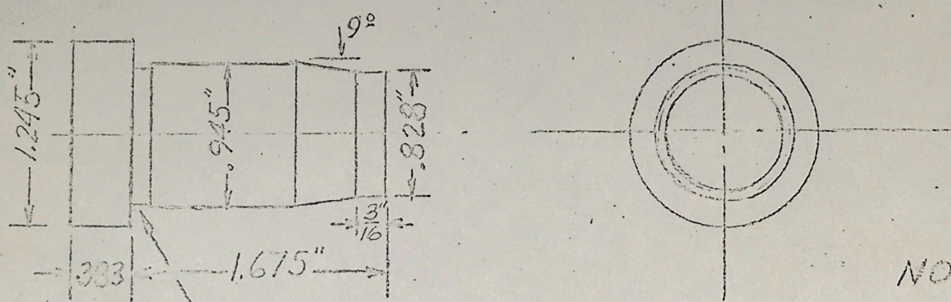
U.S. MINT. - PHILA, PA.	
DUAL DIE	
SCALE ·	FULL SIZE

PHILADELPHIA.

OBVERSE

8 A & B
9 *

TURNING DIMENSIONS
NICKEL DUAL.



UNDERCUT .020" DEEP ON A SIDE X 3/32" WIDE.

NOTE.

±.001" TOLERANCE ON ALL DECIMAL DIMENSIONS.

US. MINT. - PHILA., PA.	
DUAL DIE	
SCALE.	FULL SIZE.
DRAWN BY.	[illegible]

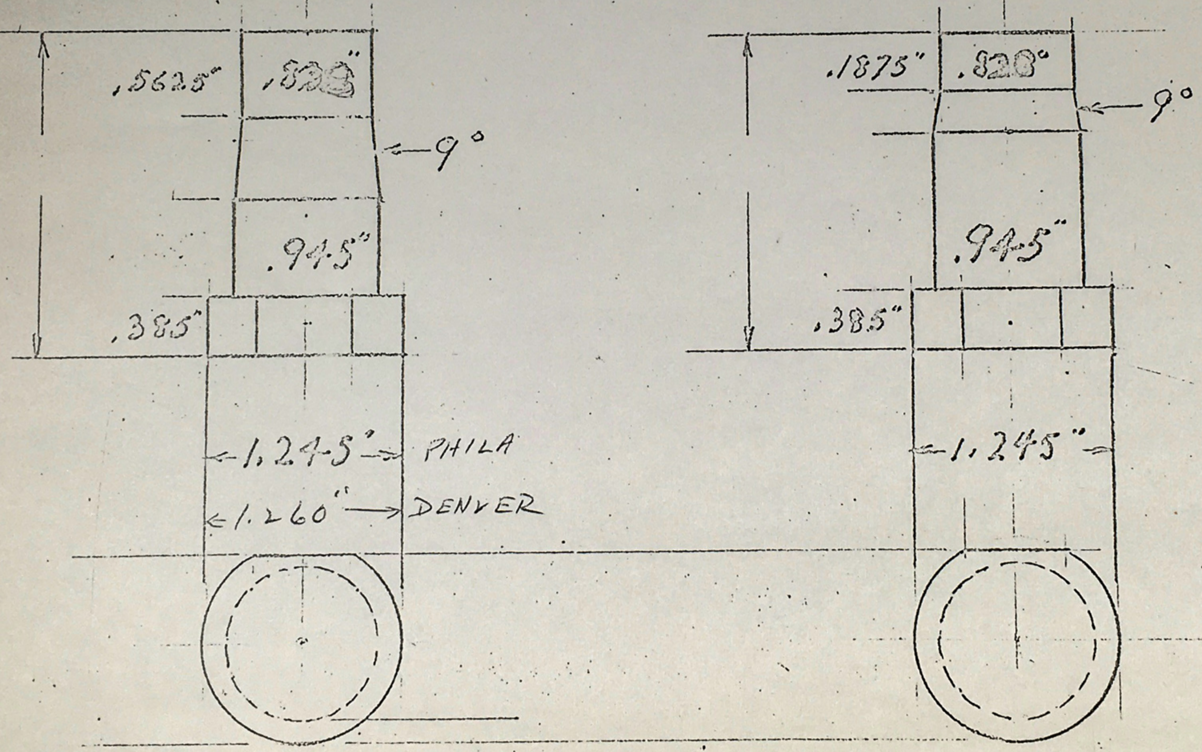
(8) AND (10)

U-S- NICKEL DUAL DIES

U-S- MINT 5-6-64

TURNING SIZE

PHILA

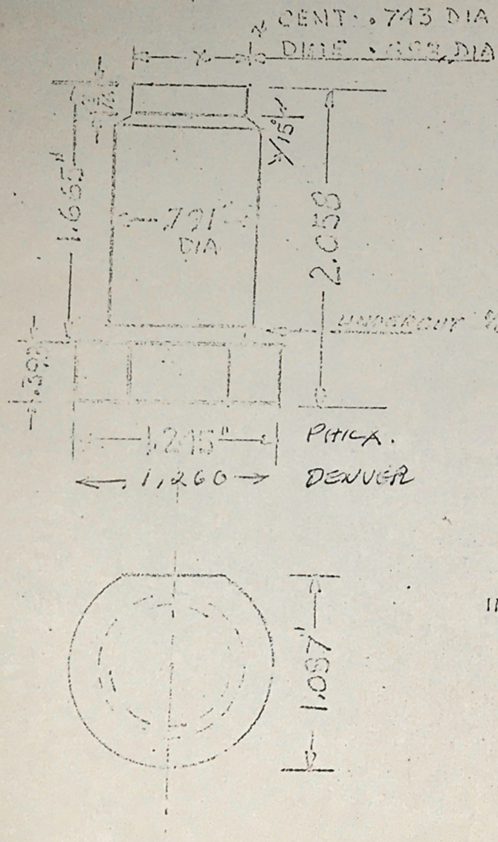


REVERSE

OBVERSE

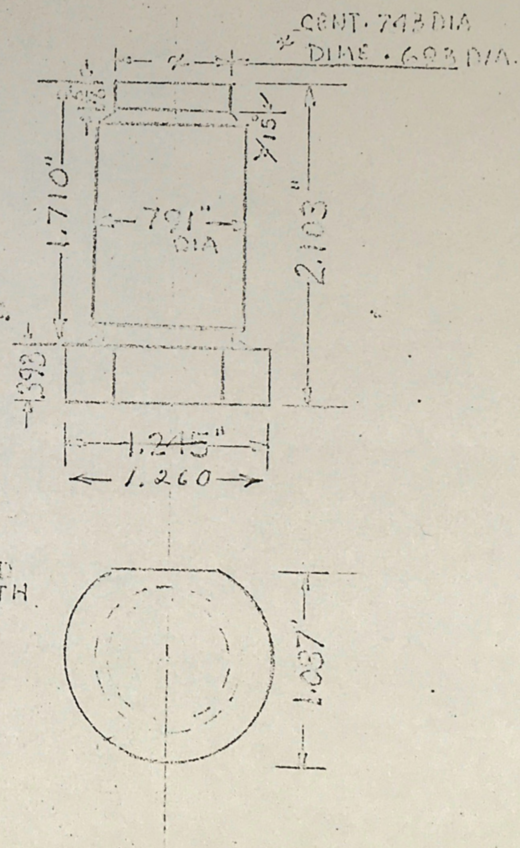
8 AND 10

MILLING & TURNING DIMENSIONS
PHILA. DUALS, ~~& PHILIPPINE DUALS~~.



OBVERSE

FLATS ARE MILLED
IN ACCORDANCE WITH
GAUGES.



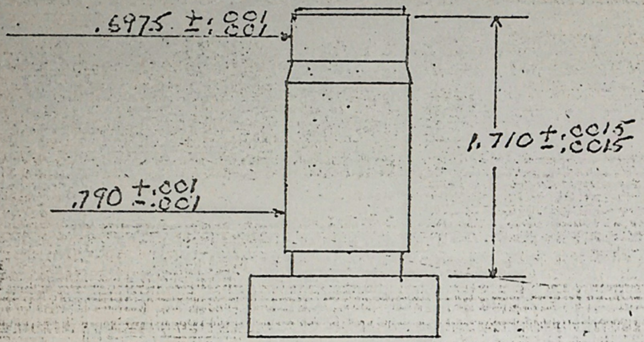
REVERSE

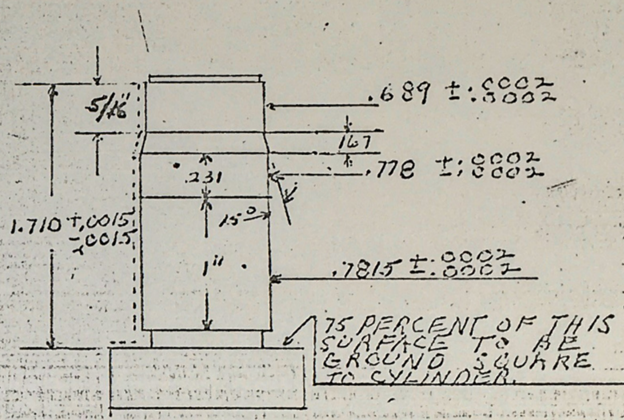
#8 & #15 & 16

TURNING SIZES

DIME

HARDEN & GROUND SIZES





DOTTED LINE DENOTES SURFACE TO BE GROUND

8.) & 15" & 16"

TURNING SIZES

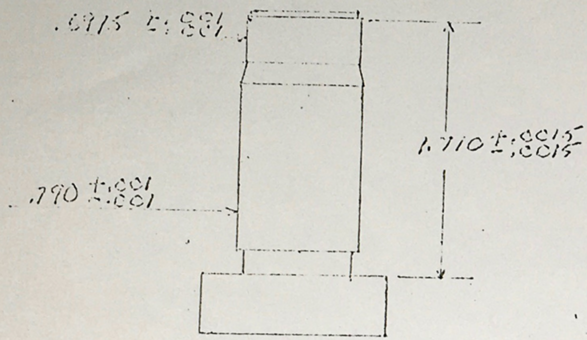
DIME

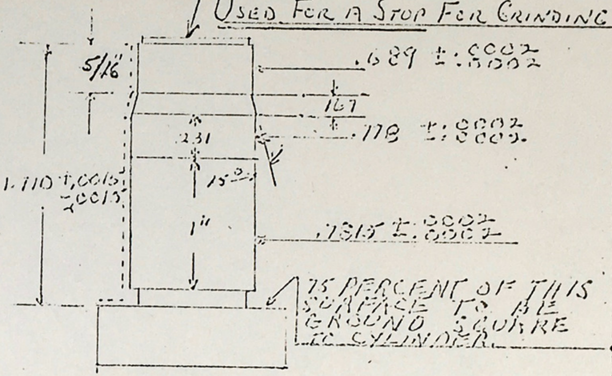
PHILA.

HARDEN & GROUND SIZES

16.

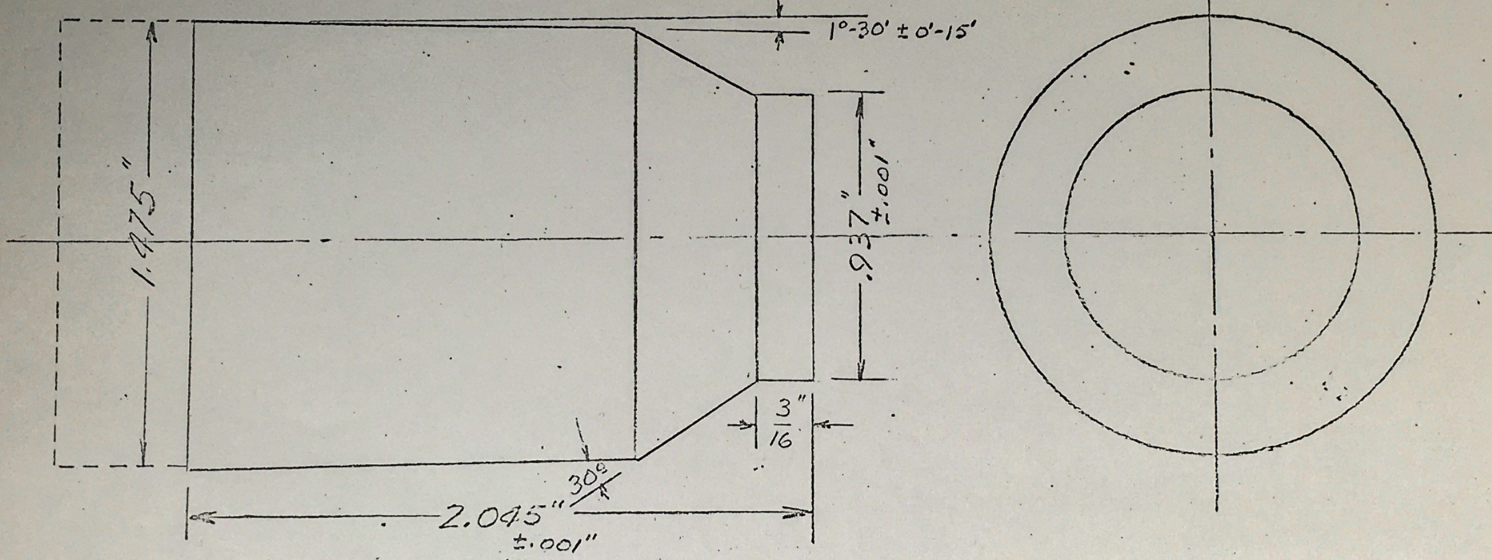
NOTE: THIS SURFACE (PORTRAIT ON AN ACTUAL DIE), CANNOT BE USED FOR A STOP FOR GRINDING OPER.





DOTTED LINE DENOTES SURFACE TO BE GROUND

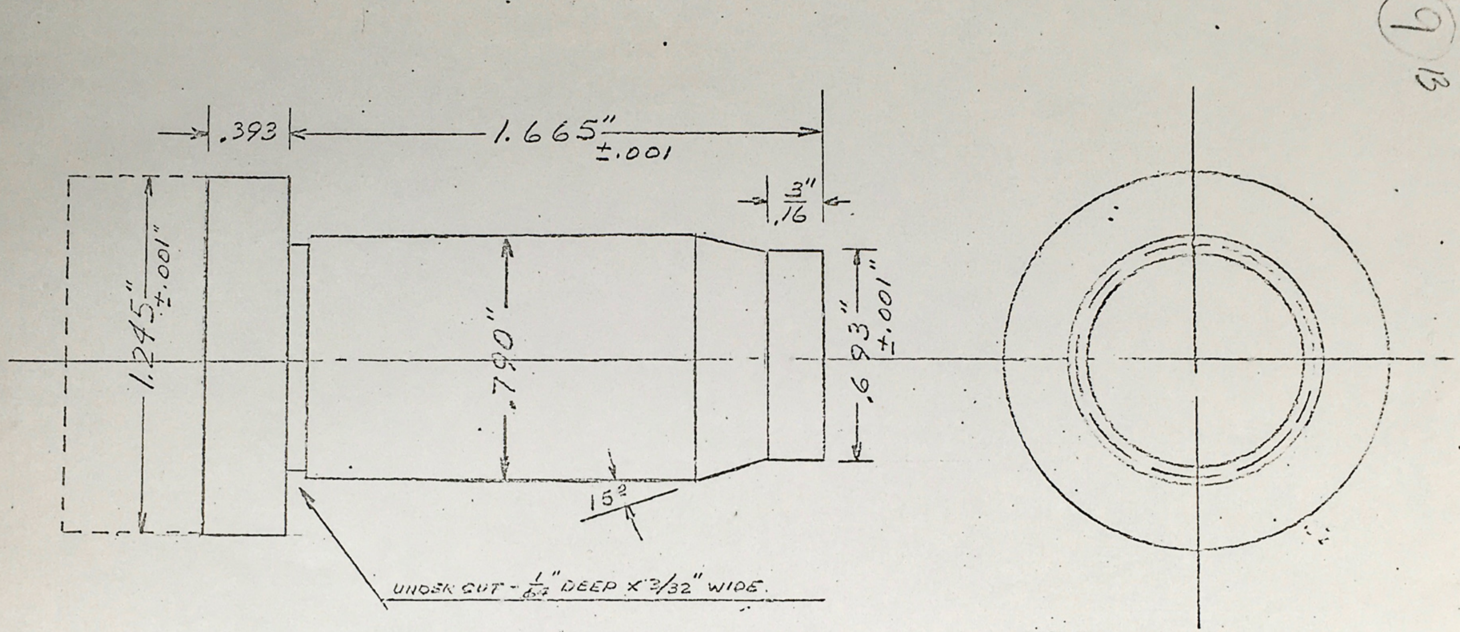
9
B



FINAL "CUT OFF" OPERATION - QUARTER DOLLAR - (OBV.)

US. MINT. - PHILA., PA.	
DIE PROCESSING.	
SCALE.	2÷1
DR'N. BY.	N. GIORDANO

TOLERANCES: FRACTIONAL - ±1/64" ; DECIMAL ±.001"; ANGLES ±1°; UNLESS OTHERWISE SPEC.



FINAL "CUT-OFF" OPERATION - DIME DUAL (OBV.)

U.S. MINT. - PHILA., PA.	
DIE PROCESSING.	
SCALE.	2 ÷ 1

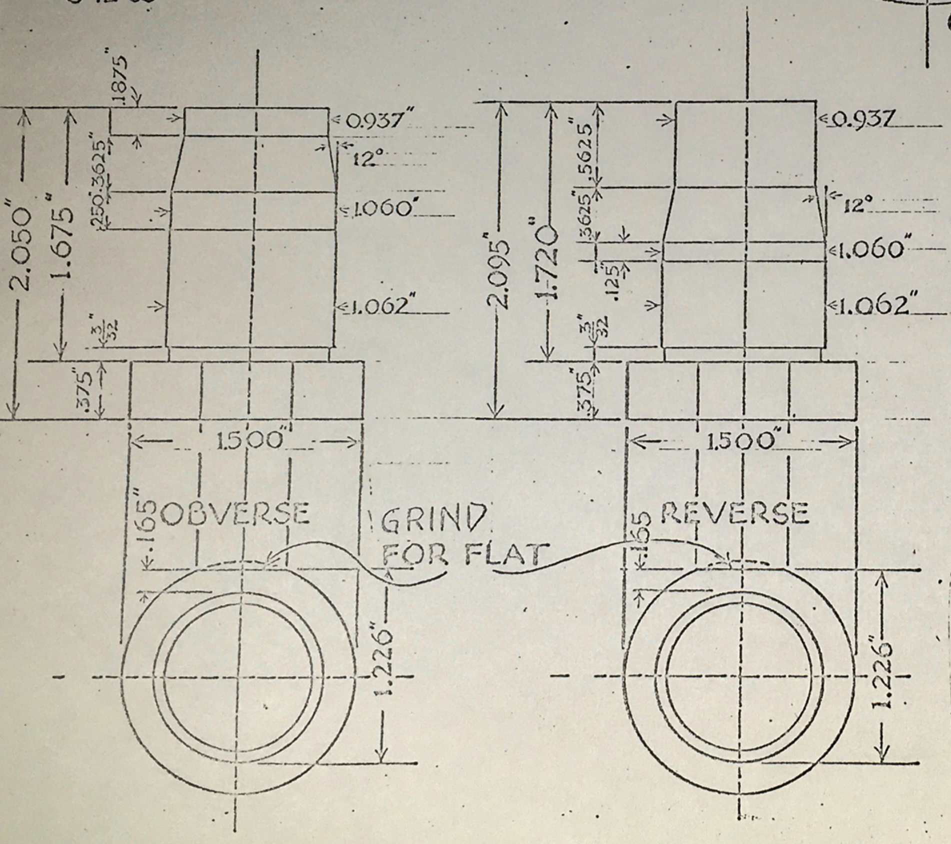
TOLERANCES: FRACTIONAL ± 1/64"; DECIMAL ±.001"; ANGLES ± 1°, UNLESS OTHERWISE SPECIFIED

~~#15~~ #16

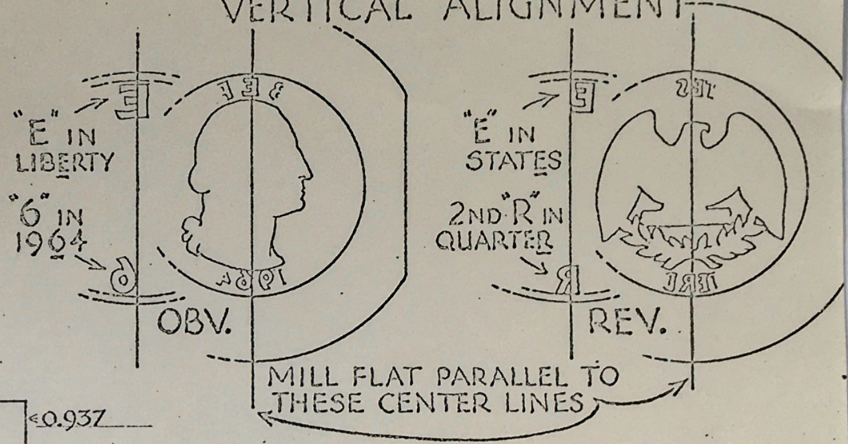
U. S.
QUARTER-DOLLAR DUAL DIES

FINISH SIZES

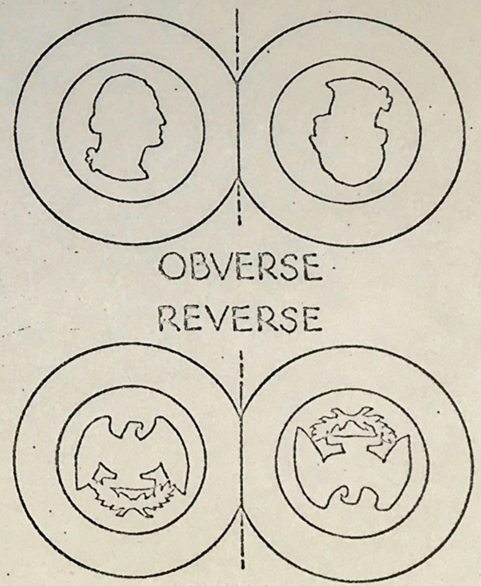
UNITED STATES MINT, PHILADELPHIA, PA.
DESIGNED & DRAWN BY S. D'ALESSIO & E. GROVE
8·12·65



VERTICAL ALIGNMENT



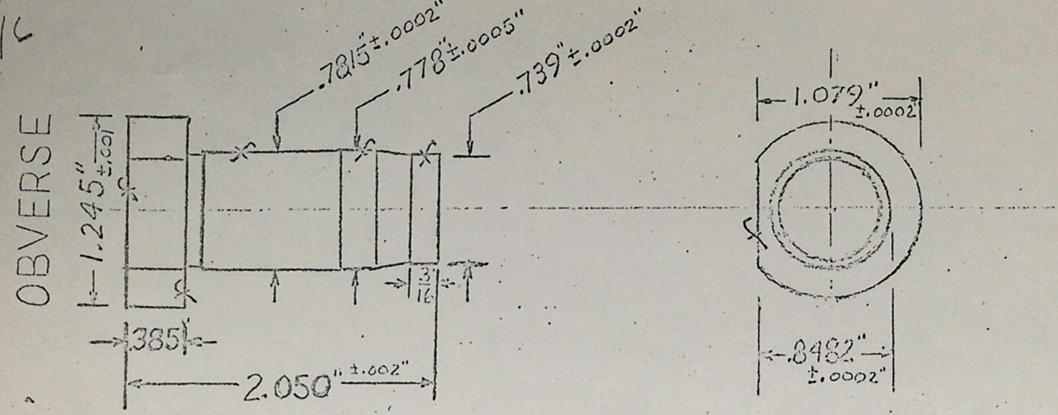
DUAL ALIGNMENT

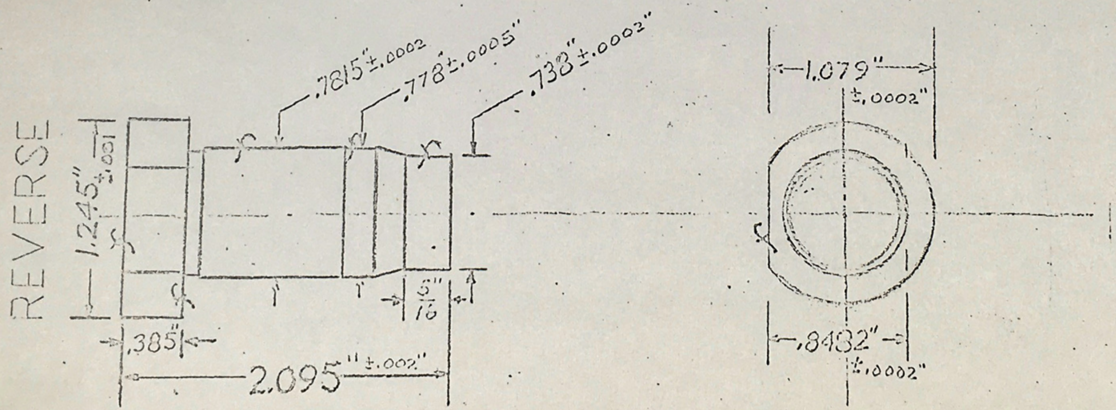


USE NEW
QUARTER-DOLLAR GAUGE

PHILADELPHIA ONE CENT DUALS FINISH DIMENSIONS

#15
#16



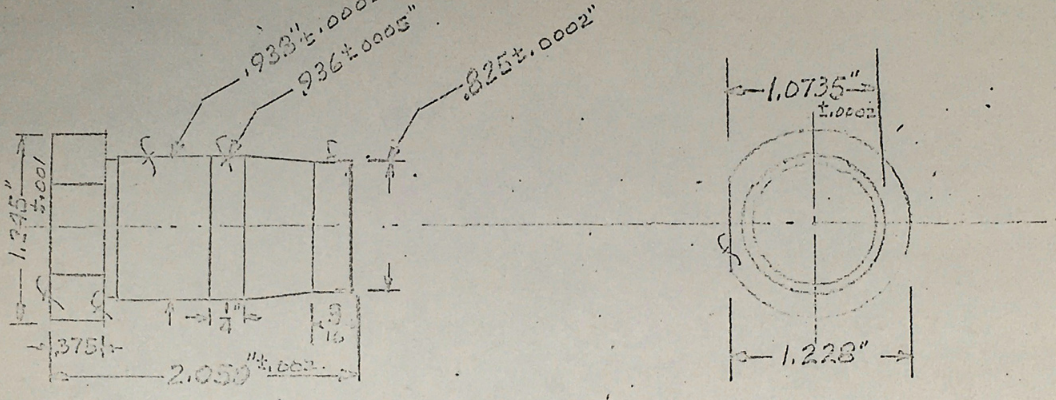


U.S. MINT. - PHILA., PA.	
ONE CENT DUAL DIES	
SCALE ·	FULL SIZE
DR'W'N BY -	N. GIORDANO.

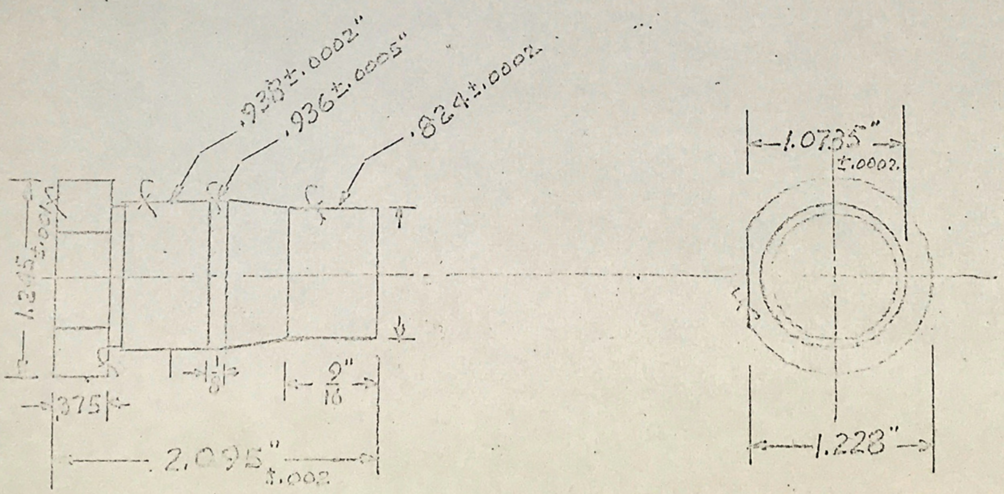
PHILADELPHIA NICKEL DUALS FINISH DIMENSIONS.

#15
#16

OBVERSE



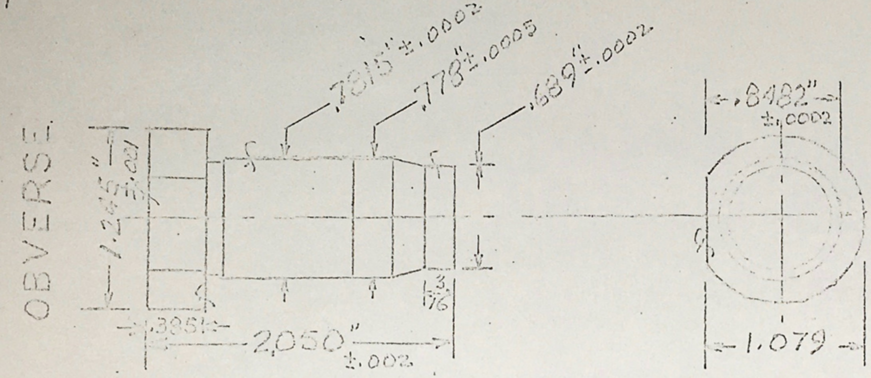
REVERSE

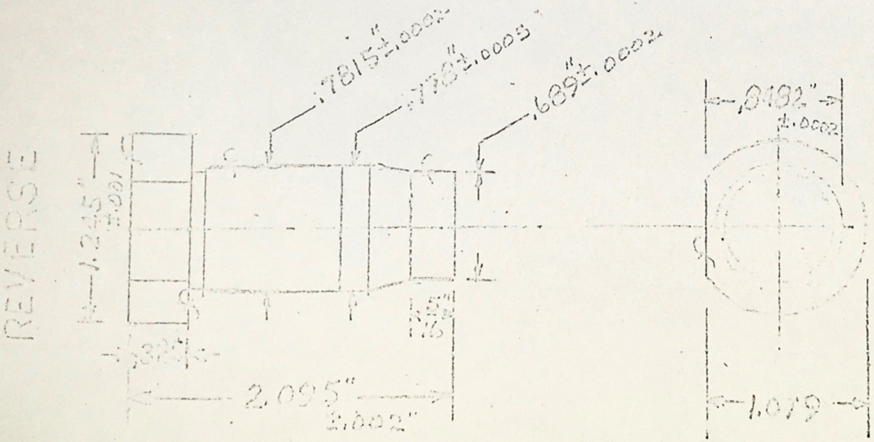


U.S. MINT. - PHILA., PA.	
NICKEL DUAL DIES	
SCALE ·	FULL SIZE.

PHILADELPHIA DIME DUALS FINISH DIMENSIONS

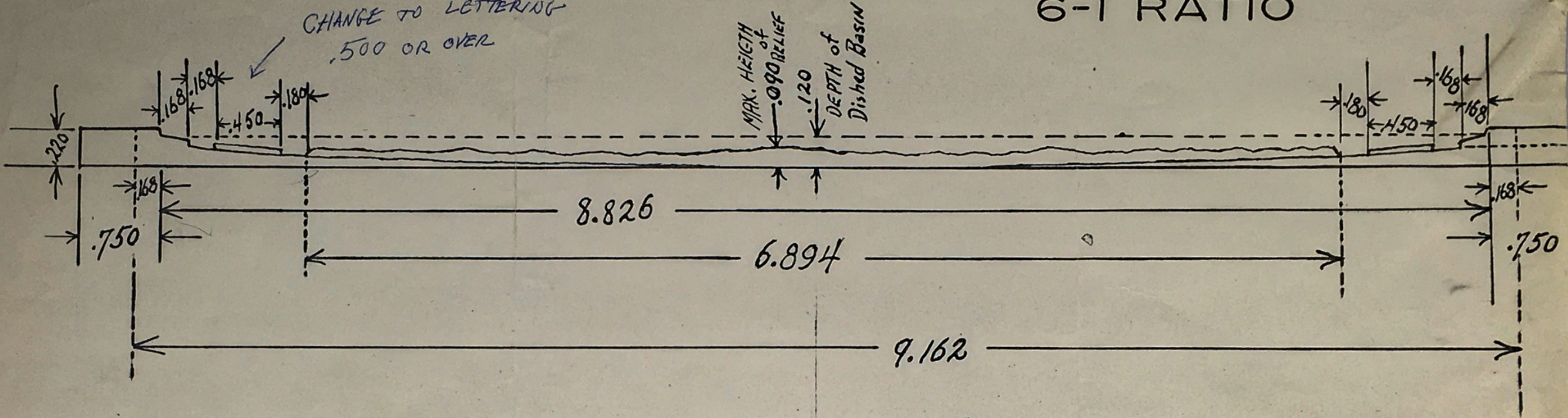
#15
#16



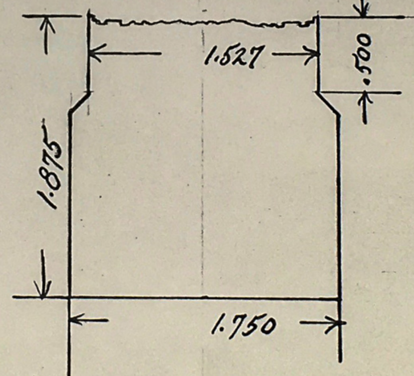


U.S. MINT. - PHILA., PA.	
DIME DUAL DIES	
SCALE.	FULL SIZE
DWN BY-	[illegible]

DISHED BASIN for 1.527 DIA. COIN-MEDAL
6-1 RATIO



REQUIRED DEPTH
OF LETTERING .033



ACTUAL DIMENSION
of COINING DIE

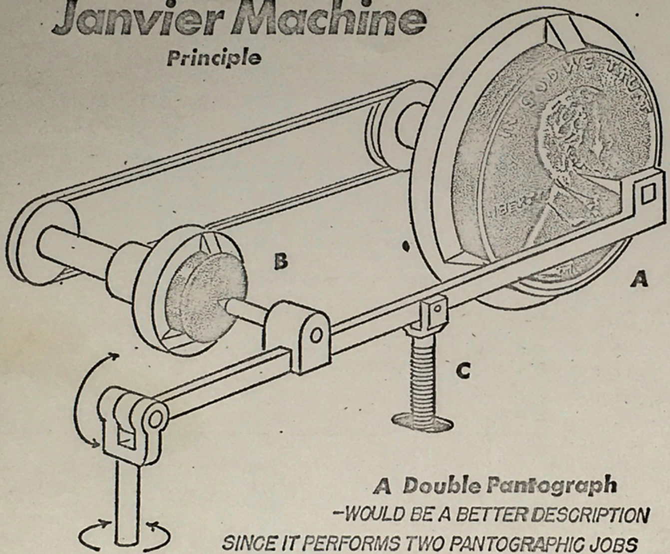
REED DEPTH .0055

by F. GASPARRO

COINOLOGY - Series 10

by Mort Reed

The Janvier Machine Principle



A Double Pantograph

–WOULD BE A BETTER DESCRIPTION SINCE IT PERFORMS TWO PANTOGRAPHIC JOBS AT ONE TIME. IT REPRODUCES THE RELIEF AND THE DESIGN OUTLINE. THE REGULAR PANTOGRAPH TRACES JUST THE OUTLINE.

THIS MACHINE CAN ACCURATELY REPRODUCE THE MOST INTRICATE DIE DESIGN–INCREASING OR DECREASING THE RELIEF AS INSTRUCTED.

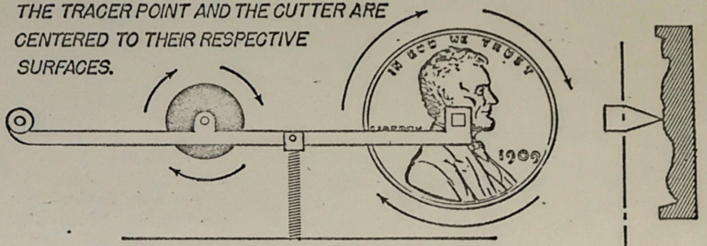
1 ORIGINAL OR INTERMEDIATE MODEL-A AND DIE STEEL-B REVOLVE TOGETHER AT A VERY SLOW SPEED. THE DISTANCE BETWEEN THE TWO CHUCKS CONTROLS THE SIZE OF THE FINISHED DIE, THEREFORE THE DIE STEEL CHUCK IS ADJUSTABLE.

2 THE HI-SPEED CUTTER IS ALSO ADJUSTABLE AND IT IS ATTACHED TO THE TRACER ARM.

3 MECHANISM-C CONTROLS THE IN AND OUT MOVEMENT OF THE ARM WHILE IT LOWERS IT MICROMETRICALLY

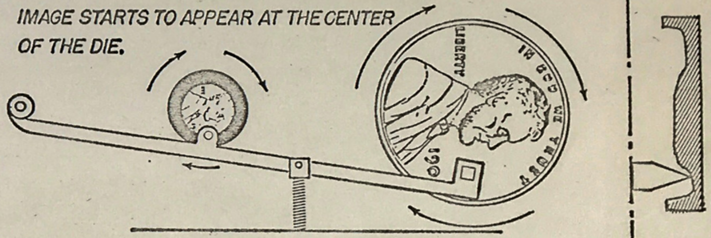
Start

THE TRACER POINT AND THE CUTTER ARE CENTERED TO THEIR RESPECTIVE SURFACES.



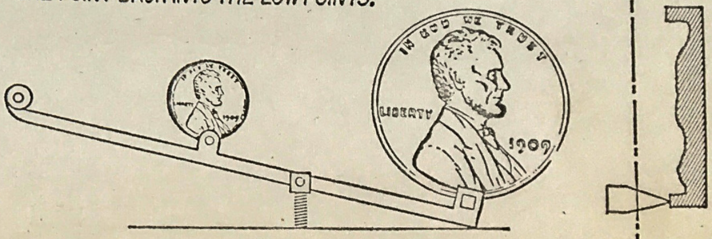
SLOWLY THE TRACER POINT STARTS TRAVELING DOWNWARD PASSING OVER THE DESIGN RELIEF.

AS THE CUTTING PROGRESSES THE REDUCED IMAGE STARTS TO APPEAR AT THE CENTER OF THE DIE.

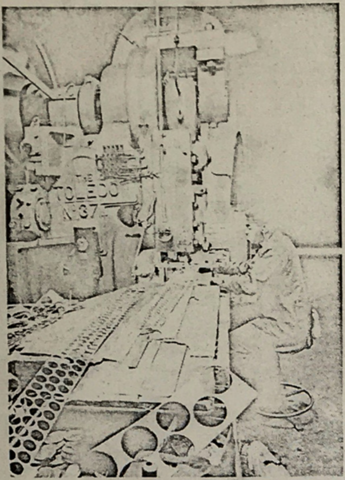


Finish

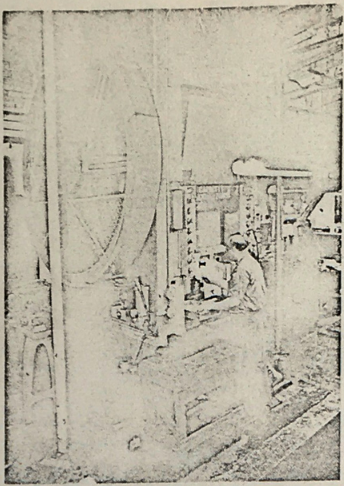
THE OUTWARD MOVEMENT OF THE TRACER IS PROVOKED BY THE HIGHEST POINT IN THE RELIEF AND MECHANISM-C BRINGS THE POINT BACK INTO THE LOW POINTS.



The die is finished

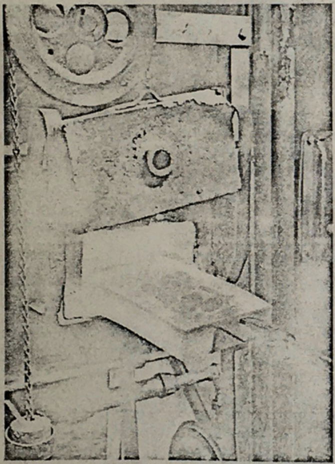


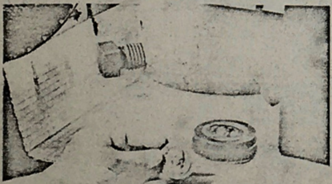
A mammoth press produces planchets or blanks from strips of bronze, gold, silver, nickel, etc. Its action is much like that of cookie-cutter.

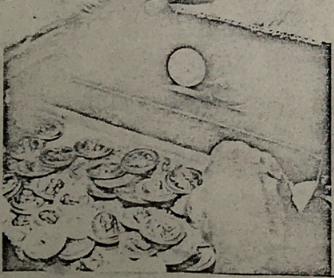


This press is one of the largest pieces of equipment in New York City. It weighs equivalent of two locomotives and develops 1000-ton pressure.

At a 250-ton press, smaller medals receive first blow. Art medals stand out because they receive multiple striking to develop high relief.







After last strike circular medals are placed in trimming lathe and excess material ("flash") is removed. The edge lettering is stamped on the medals immediately after this process.

Each strike hardens the medals which must be resoftened by annealing before next strike. At left, above medals are heated to 1200 degrees then plunged into water, acid, washing and drying baths. At left, a Presidential Art Medal receives one of its four separate strikes. Note material squeezed out.

TRANSFER ENGRAVING

<u>Procedure for making Galvanos</u>

The Sculptor-Engraver submits to the Transfer-Engraver a model of his work. This is modeled in plastalene (modeling clay) on a lay-out board. A metal band is placed around the model, encasing it in a desired diameter. The band is secured to the lay-out board by placing plastalene around the inner and outer bottom edge. Then ice-cold water is poured into the encased area. Make sure there is no leakage. After a chilling period of one-half hour, remove the water.

Prior to pouring water, an application of separator is applied to the model and surrounding area by brushing ever so gently, so as not to disturb the detail of the model.

After water is removed, it is then ready for plaster. Mix plaster accordingly as to the amount and texture desired. Pour into the encased area and shake (vibrate) vigorously for a few moments. This will enable the air bubbles to rise to the surface. Let set and harden. Check periodically, and when plaster is very warm, remove metal band. After it cools, it is ready to separate. Remove cast from the model, inspect and return to the Sculptor-Engraver. After he inspects the cast for any flaws, and if the case may be, he will repair same. He then returns the plaster cast, so that a positive cast be made from the first one.

AFTER #2

LACQUER AND THINNER CAN BE PROCURED FROM SHERWIN-WILLIAMS CO. U.S.A.

AFTER #4

USE SEPARATOR OR KEROSENE (70%) MIXED WITH BEES WAX (30%)

AFTER #10

TANK - 24"X36"X22"

COPPER SULPHATE SOLUTION

BUSS BARS -

BAR HOLDING PLASTER ATTACHED BY NEGATIVE WIRE.

BAR HOLDING ANODES ATTACHED BY POSITIVE WIRE.

ELECTROPLATE CONTROL PANEL

VOLTAGE - 4 VOLTS - 30 AMPS

When making a cast from another cast the following steps are taken:

1. Make sure cast is thoroughly dry.
2. Using a mixture of Lacquer & Lacquer thinner, pour over cast making sure entire area is saturated. This acts as a sealer. Let it set and solution will evaporate.
3. Place cast on lay-out board and secure a metal band around diameter of cast. Use plastalene around inside surface of band to seal and fill in irregular openings. Make sure there is no visual openings.
4. Brush on the separator, evenly and smoothly, making sure there is no coagulation of separator. Brush off excess. Separator consists of bee's wax and kerosene.
5. Prepare plaster of paris for pouring. Place desired amount of water in a mixing container. Pour in plaster by spooning, until it just about covers the water level, then stir first by spoon and finally by hand. Make certain there are no lumps of plaster. When texture is correct, pour into the encased cast. Vibrate to bring air bubbles to the surface. Let it set and harden. When cast is ready for removal, use a thin blade between the seams of the cast. Tap gently and this will release the work. Remove top cast and return both to the Sculptor-Engraver.
6. After final inspection by the Sculptor-Engraver, the cast is returned for processing.

The following steps are taken for producing galvanos:

1. Make sure cast is thoroughly dry and free from any sealers.
2. Score a groove completely around diameter of cast. This is to accept two strands of wire for hanging purposes.
3. Place in heated kiln for one-half hour at 90°-100° C.
4. Place in melted bee's wax and make certain it is under wax level at least 1/2".
5. Let cast remain in bee's wax for two hours.
6. Remove from wax and brush away wax. Brush away excess wax making certain there is no build-up of wax.
7. Place on two sticks on work table. Commence to brush on Electro-Copper powder. Start from the outside diameter, outer surface, and work into center.
8. Remove to cool area and let stand to cool.
9. Place two copper wires around grooved diameter and secure to hangers.
10. Blow off excess copper powder and place into plating tank. Use about three volts. The work should remain in the tank for at least five days. This will give a very good deposit of copper.
11. Remove from tank and rinse with clear water. Hang and let dry for a day.
12. Remove wire hangers and band saw around diameter excess. Then place over gas flame the copper surface. This will loosen the galvano from the plaster cast. Remove the galvano from the cast and clean the finished surface.

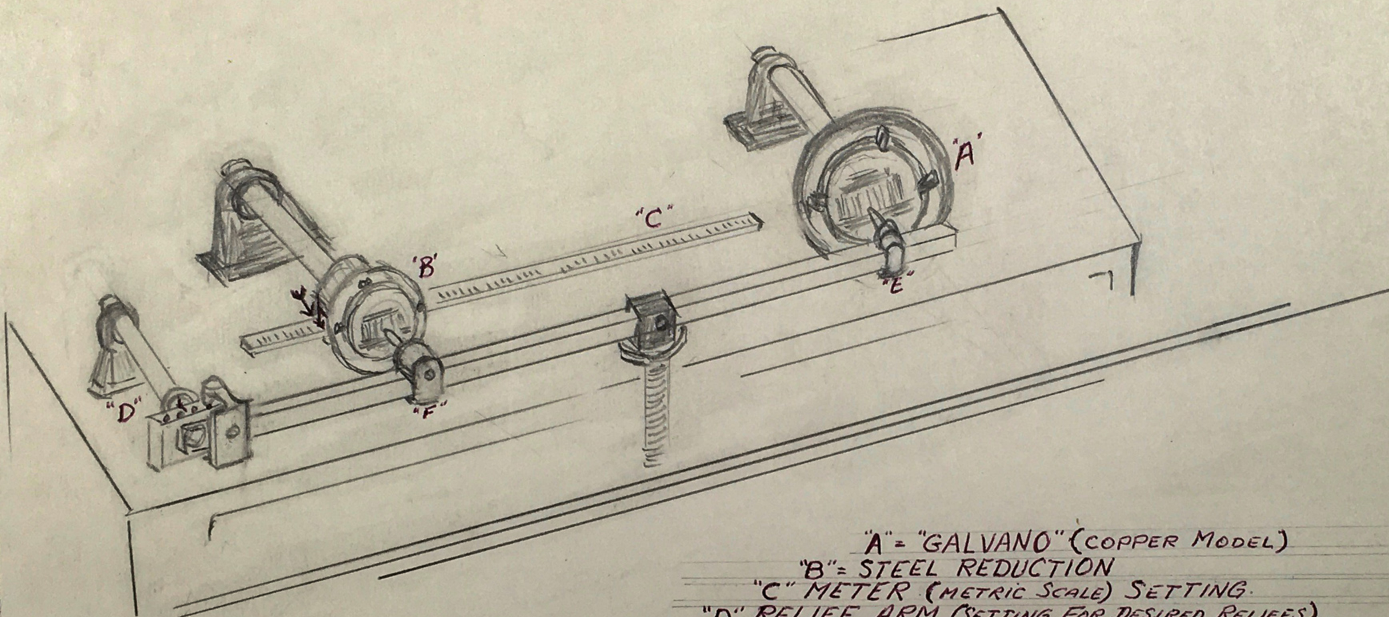
When cleaning, use kerosene and wire brush. Then rinse and finish cleaning with strong detergent and rinse in clear water. Dry and return to Sculptor-Engraver.

13. The Sculptor-Engraver will final inspect the Galvano.
14. The Galvano is returned to the Transfer-Engraver for backing-up.
15. The Galvano is placed "detail" side down on a lay-out board. A band is secured around the diameter. Plastalene is again used for sealing the irregular edge. Plaster is mixed and poured into the encased Galvano. When plaster is set, remove the band and let dry. Galvano is now backed-up and ready for mounting on face plate.
16. When Galvano is mounted on face plate of reducing machine, be certain that it is level and concentric. This is very important, especially when making a die.

-oOo-

ONE CENT REVERSE

GALVANO SIZE = 7.305" (ID) — 185.5 MM.
HUB SIZE = .698" (ID) - 17.7 MM.
RATIO = 10.4 ÷ 1



"A" = "GALVANO" (COPPER MODEL)
"B" = STEEL REDUCTION
"C" METER (METRIC SCALE) SETTING.
"D" RELIEF ARM (SETTING FOR DESIRED RELIEFS)
"E" = TRACER., "F" = CUTTER.,

GALVANO (MODEL) IS SET AT A FIXED POSITION. THE STEEL REDUCTION IS MOVED TO THE DESIRED POSITION ON THE METRIC SCALE. THE RELIEF ARM IS ADJUSTED TO GIVE THE DESIRED HEIGHT OF RELIEF. THE MODEL AND REDUCTION ARE CENTERED IN RESPECT TO ONE ANOTHER. THE TRACER IS STATIONARY AND THE CUTTER REVOLVES AT A HIGH SPEED WHILE CUTTING.

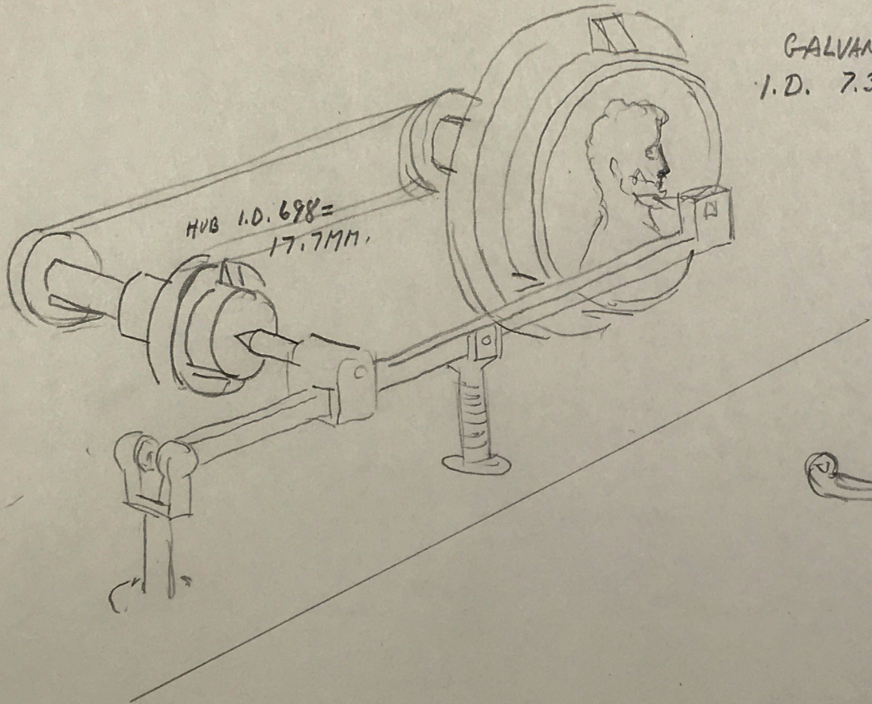
EXAMPLE.

GALV. SIZE "A" = 7.305" (ID) = 185.5 MM. = MACHINE SETTING = "C" SCALE READING (MM.)
HUB SIZE "B" .698" (ID) = 17.7 MM. RELIEF ARM "D", SETTING FROM CENTER OF ARM TO DESIRED PIVOT.
RATIO = $\frac{10.4}{1}$

ONE CENT REVERSE

RATIO $\frac{10.4}{1}$

#1120 MACHINE SETTING = 107.1 MM.



I.D. GALVANO 185.5MM.

I.D. HUB. 698 – 17.7MM

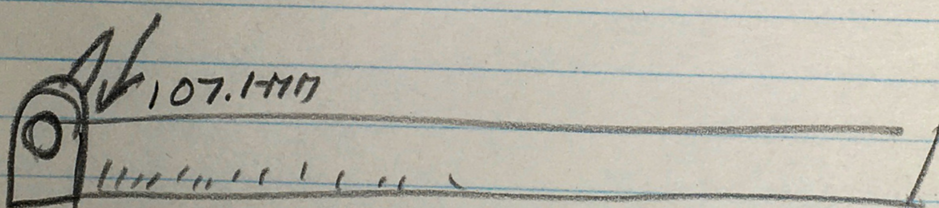
1120. MACHINE MM.

X 17.7 MM

19870.0

GALVANO 107.1-M.M.

185.5) 19870.



17. The Transfer Engraving Machine is now readied for making a reduction. The Transfer Engraving is informed as to what size to make the reduction. From this information he arrives at a setting for the machine. This is done by either triangulation or by use of a formula. The proper ratio is established and the stylus or tracer, and the cutter is ground and honed accordingly. The "Galvano Model" is then placed on the Machine and the steel is placed in its receptacle also. Both of these members must be concentric and parellel to each other. This makes it possible to eliminate any exaggerated error.

The relief is also designated by the Sculptor-Engraver and the relief arm of the machine is then set to its desired setting. This will establish the height of relief. After the final cut is taken, the work is measured and its detail is inspected very closely. Accuracy and quality is very important. This procedure is for Master Dies, Hubs, etc., etc. Both negative and positive wax enlargements are also cut on the Transfer Engraving Machine.

The Mechanical Features of the machine enables the arm to move from a horizontal (leveled) position to a downward position. The tracer is stationary, and the cutter revolves at a speed of approximately 3500 RPM. Both the model, and the steel being cut, revolve at a slow speed simultaneously. The tracer will "pick-up" every minute detail, and in turn the cutter reproduces it in the steel. Below is an example of how the machine setting is determined:

"The New Lincoln One Cent Reverse"

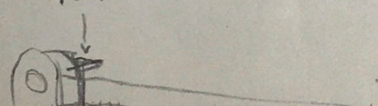
Galvano Size = 7.305" (I.D.) = 185.5 mm
Hub " = .698" (I.D.) - 17.7 mm
Ratio = $\frac{10.4}{1}$ This is the ratio of the Hub to the pattern.

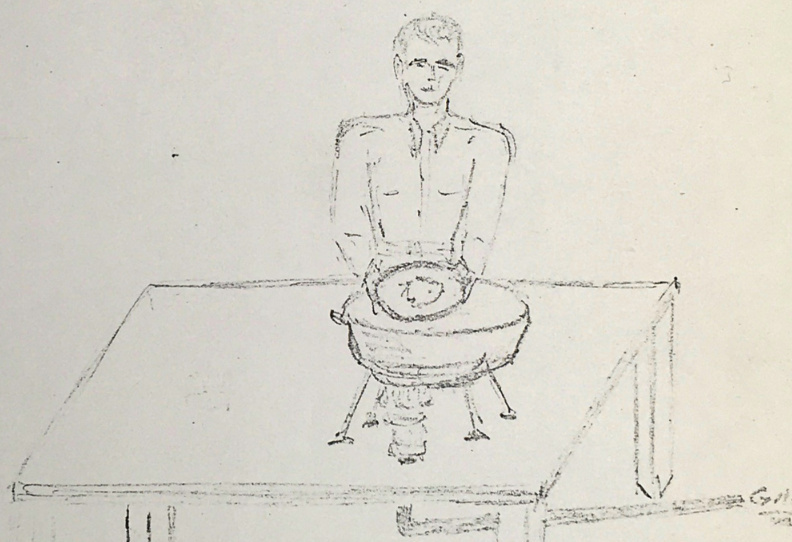
#1120 Machine Setting = 107.1 mm

1. Multiply Hub Size x Machine Size = 1120 m.m.
   17.7 m.m.
   =19870.0
2. Divide product of Step "1 by Galvano Size = 185.5)19870.00 = 1071

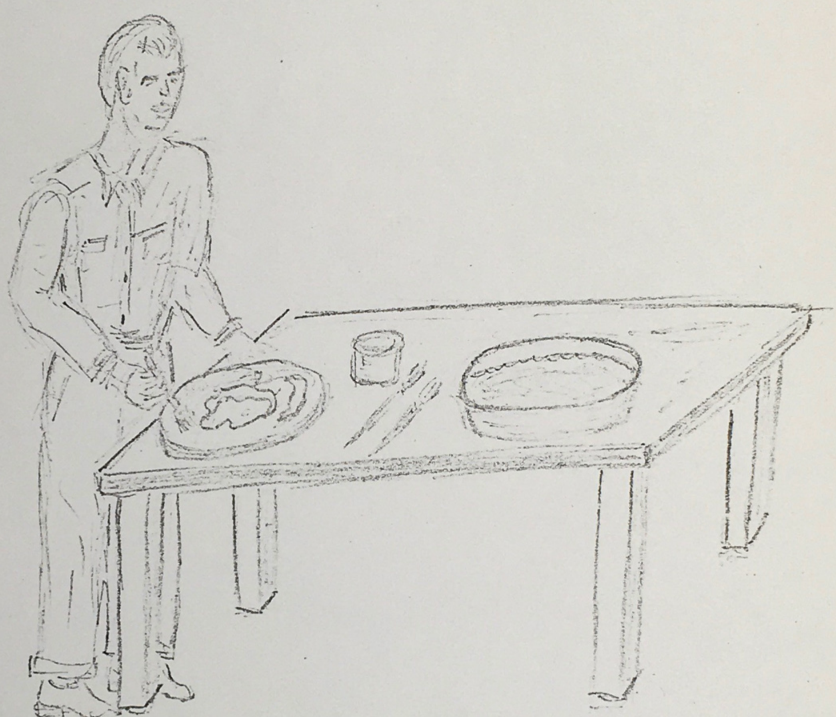
The Sum 107.1 is the setting for the Transfer Engraving Machine pivot arm.

107.1



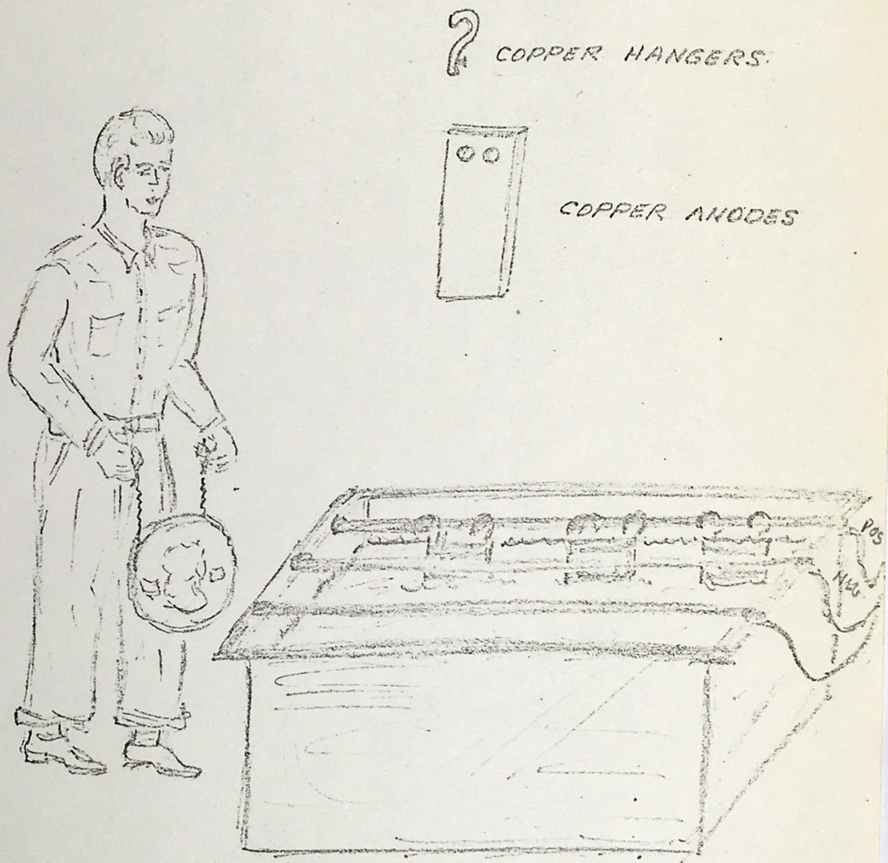


INSERTING CAST INTO MELTED BEE'S WAX.   STEP NO. 1



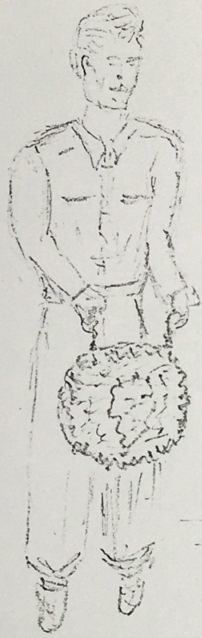
REMOVAL OF CAST FROM WAX, AND BRUSHING ON ELECTRO-COPPER POWDER.

STEP NO. 2



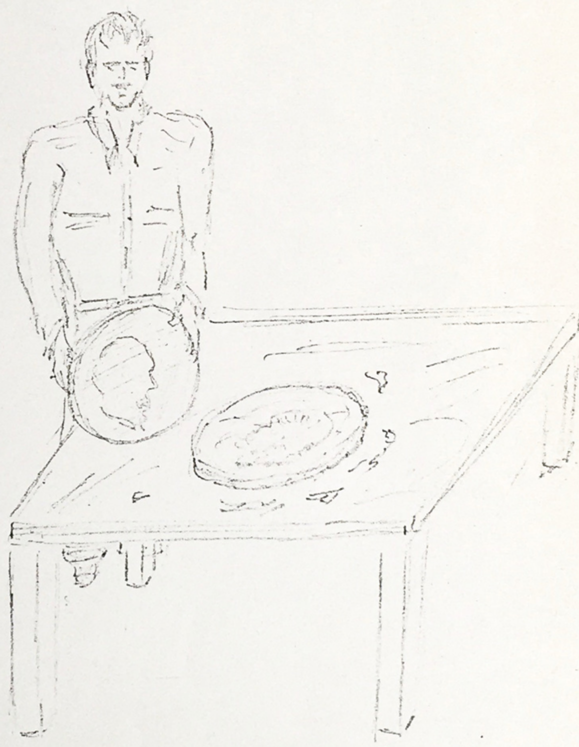
SECURING CAST WITH COPPER WIRE & HANGER FOR IMMERSING INTO COPPER-PLATING TANK. TANK CONSISTS OF COPPER-SULPHATE SOLUTION, COPPER ANODES, HANGERS, AND BUSS BARS.

STEP NO.3



GALVANO AFTER REMOVAL FROM PLATING TANK. NOTE THE ROUGHNESS OF DEPOSIT.

STEP NO. 4



AFTER ROVAL FROM TANK, GALVANO IS DRIED AND THEN SEPARATED FROM PLASTER CAST OR MOLD, REVEALING THE FINISHED SIDE. THIS IS THEN CLEANED THOROUGHLY.

STEP NO.5

TRANSFER ENGRAVING

Plastic Displays

When making plastic displays of commemorative medals, the following procedure is used:

1. Clean surface and detail of die thoroughly.
2. Use a thin application of separator (kerosene and bee's wax).
3. Brush on gold-leaf powder and remove excess.
4. Pour Hysol plastic on prepared surface.
5. After plastic hardens, remove from die.

When using Hysol plastic for display purposes, it is important that the proper ratio is used. Use 5 to 1 ratio of laminating compound.

Laminating Compound - TC8-4344 (white) = 5 parts

Hardener - TH2-3520 (amber) = 1 part

TRANSFER ENGRAVING

<u>Sources of Supplies</u>:

Plaster	Industrial Plaster Pottery - K-59 Bestwall Gypsum Company Ardmore, Pennsylvania
Electro-Copper Powder) Gold-leaf Powder)	United States Bronze Powder Works Flemington, New Jersey
Plastic:) Laminating - TC-4344) Surface - TC-4343) Hardener)	Hysol Corporation Olean, New York
Wax (pure refined yellow bee's wax)	Stevenson Brothers and Company 100-110 Race Street Philadelphia, Pennsylvania

Mr. Gasparro w/manual
Engel
Leone
Wolf
7/26/68

RECEIVED

TREASURY DEPARTMENT
WASHINGTON, D.C. 20220

JUL 26 9 12 AM '68

OFFICE OF
DIRECTOR OF THE MINT

July 25, 1968

Mr. Michael H. Sura
Superintendent
United States Mint
Philadelphia, Pennsylvania 19130

Dear Mr. Sura:

Several months ago, the State Department requested this office to assist in making available, through the United Nations, a candidate capable of offering technical assistance to the new Mint in Israel. It was stated that the facility houses a hydraulic press, stamping presses, and allied equipment. In the absence of more detailed information, it appears that the Israel Mint is capable of producing working dies and collars from master hubs produced elsewhere, and equipped to mint coins from blanks furnished by others.

Mr. Carl Borchert, Coin Production Supervisor, at the San Francisco Assay Office, has been selected for the assignment; he has been interviewed by the United Nations people, and it is expected that he will be requested to report in Israel early in September.

Since Mr. Borchert has had no experience in the production of working dies, we are assigning him for training under the tutelage of Mr. Gasparro, your Engraver, for one to two week's training. In addition to the production of working dies, he should be instructed by the Superintendent of the Mechanical Division in the making of collars, and by the Superintendent of Coining for any additional information he requires on press set-up, die setting, etc.

Mr. Borchert will report for duty at your Mint on Monday, August 5, 1968, at 9:00 a.m. I am sure that you will extend to him the full cooperation of your staff.

We enclose a copy of our letter dated July 25, to the Officer in Charge, U. S. Assay Office, San Francisco which is self-explanatory.

At the request of Mr. Gasparro by telephone to Mr. Neisser, we also enclose a copy of the restricted document entitled "Engraver's Manual - Gasparro & Macellaro - 1964", for use in updating this information with Mr. Borchert.

Sincerely,

For S. F. Carmile
Frederick W. Tate
Acting Director of the Mint

Enclosures

RECEIVED
SUPERINTENDENT
U. S. MINT
PHILADELPHIA, PA.

JUL 26 9 12 AM '68

July 25, 1968

Mr. John R. Carr
Officer in Charge
United States Assay Office
155 Hermann Street
San Francisco, California 49102

Dear Mr. Carr:

This letter concerns the planned temporary assignment of Mr. Carl Borchert, Coin Production Supervisor of your institution, to provide technical assistance to the new Mint in Israel.

We enclose in duplicate, with one copy for Mr. Borchert, copies of the following:

Our letter dated July 25, 1962, to the Superintendent at Philadelphia concerning Mr. Borchert's temporary assignment for training in die making.

Travel authority for Mr. Borchert, covering his planned trip to the Philadelphia Mint.

We also enclose one copy of an official document, restricted for Mr. Borchert's official use only, entitled "Engraving Operational Manual - U. S. Mint Philadelphia - F. Gasparro and A. Macellaro - 1964".

Mr. Borchert shall, in the course of his training under the Engraver at Philadelphia, prepare an updated version thereof, containing additional detail process data to assist him later in meeting the requirements of his assignment.

Three copies shall be made; one for the official files of the Superintendent at Philadelphia, one for the Engraver, and one for submission to this office.

The official document or documents he carries with him are not to be shown to others; nor shall he reveal that he has such documents, and under no circumstances are any copies thereof to be made.

Upon completion of his training assignment at Philadelphia, Mr. Borchert is to return to work at your office, and to await further instructions concerning the trip to Israel.

Sincerely,

(S) Carmichael
for Frederick W. Tate
Acting Director of the Mint

Enclosures
cc: Mr. Carl Borchert, Mr. Michael Sura, Mr. Frank Gasparro

PBN:mcw EBL SFC PJP

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Acting Director of the Mint

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cc: Mr. Carl Borchert, U.S.A.O., S. F.
✓cc: Mr. Frank Gasparro, Engraver, Phila. Mint

PBN:mcw EBL SFC PJB

FRANK GASPARRO

F. Gasparro and
A. MACELLARO
1964
AUTHOR

[redacted]

THIS COPY FOR
FRANK GASPARRO

ENGRAVING OPERATIONAL MANUAL

U.S. MINT PHILADELPHIA

This Document for
OFFICIAL USE ONLY

RESTRICTED

Per Philip B. Nessier
Tech. Consult.
Bur. of Mint Wash. D.C.

NO photostat
or other copies
to be made

Sketch -- Usually a pencil drawing 3 to 5 times larger than the size of the intended piece. This is prepared by an artist, its purpose is to portray a fairly complete representation of the idea and appearance of the finished piece, composition, arrangement, style, type and size of lettering, purpose, dates, etc.

Model -- Using the sketch and or photographs a relief model is made in plastilene (modeling wax) several times larger than the intended piece, separate models are made for the obverse and reverse sides. These are built up on flat boards that have been shellacced, or on plaster discs that have been turned up to include a border and concave basin (field). These are also given a coat of shellac. At this time the height of relief is established keeping in mind the ratio of the model to the finished piece. Much of the lettering and finer detail is left out. It is more practical to do this in the negative.

Negative - Plaster The original sculptured model is surrounded by a band or 'fence' of stiff waxed paper or thin metal strip. This is fastened to the board or wrapped around the plaster disc and sealed with additional plastilene. A very thin film of olive oil or mineral oil is brushed over everything, including the inside of the band. Plaster of paris (gypsum) is mixed with water to the consistency of thick cream and poured over the model, sufficient to completely cover the highest part of the design by a half inch or more. After the plaster has set, about 45 minutes, it can be lifted away from the plastilene and further work can be done with metal tools in this negative. Final detail and lettering can best be done at this stage.

Positive - Plaster All undercuts are carefully removed from the negative plaster and it is brushed with a coat of shellac or Opex (Sherwin Williams sanding filler), and after drying, a thin film of petrolatum or Dow Corning #7 compound (silicon lubricant) is applied. A flat band or strip is secured around the outer edge and a creamy plaster-water mix is poured

in to 1 inch or more thickness. Jiggling or vibrating the negative during this operation helps to prevent air bubbles. After the plaster has set, the band is removed and by carefully wedging with a knife blade and tapping gently, the two plasters will separate. Final cleaning up and finishing is done at this stage.

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GALVANO PROCESS

- These are copper replicas of the plaster model and are prepared by thoroughly drying the completed plaster model, either negative or positive, and immersing in very hot beeswax until all bubbling
2 ceases, then removing and when nearly cool, dusting with finely powdered copper, getting into all parts of the design and around the outer edge of the plaster. A copper wire is wrapped around this outer edge making contact with the powder. The dusted plaster is then suspended in a copper plating tank, with the wire attached to the
3. proper bus bar. Copper is plated from solution by electrolysis directly onto the design and plating is continued till a thickness of about 1/16th inch is deposited, - about 4 days. The plated plaster is then removed from the tank and the extreme outer edge is cut away on a band saw and the copper electrotype separated from the plaster. After cleaning up and backing with solder or asphalt, it is turned true (flat) on the back, and is ready for clamping to a face plate on the Janvier engraving-reducing machine. These galvanos can also be given a decorative finish by plating or otherwise, and used for exhibit purposes.

EQUIPMENT.

QUAN. OF UNITS	NAME	SIZE	AREA CONSUMED
6	ELECTRO PLT. TANKS	21' - 9'	189 sq. ft for 6 units
1	DRILL PRESS	2'-6" x 2'	5 sq. ft
1	BAND SAW	3' x 3'	9 sq. ft
		TOTAL AREA	203 sq. ft

CONFIDENTIAL

JANVIER MACHINE

-- The principle purpose of the galvano is for use as a pattern on the Janvier machine. This machine traces over the design and reproduces all details in reduced size in a piece of annealed tool steel. A positive galvano is used to prepare a hub and a negative galvano for a die. A die cut directly on the machine can be turned to fit the press, hardened and used for striking medals or coins. Where a large run of coins or medals is contemplated, a hub (positive) is made, turned and hardened, and used as a punch or hob in an hydraulic press to form a number of dies. Final diameter is established at this time.

QUAN. OF MACH.	NAME	SIZE	AREA CONSUMED.	H.P.
1	JANVIER	6'-6" x 3'-6"	23 sq ft	1/3
1	"	6' x 3'-6"	21 sq ft	1/2
1	"	4'-6" x 3'	13.5 sq ft.	1/4
		TOTAL AREA	57.5 sq ft	

CONFIDENTIAL

PREPARATION OF DIE BLANKS.

Annealed tool steel bars, approximately 12 ft. long, are fed into a turret lathe. This machine cuts short lengths from the bar and also shapes one end of these short lengths into a cone. For U. S. coinage, the angles of cone, diameter and length used are shown on drawings included in separate folder. An analysis of the tool steel used is included in the specifications herewith. The rough blanks from the turret lathe are fastened in a 3 jaw chuck on an engine lathe and a leveling cut is taken across the flat end with a slight depression cut in the center for leveling. The cone on these blanks is then fine ground against a rotating steel disc faced with abrasive cloth #Carborundum Aloxite Type 3 320 x Resin Industrial Cloth. This is done by rotating the cone by hand in an adjustable fixture (for cone angle) against the revolving disc. This disc grinder consists of a $7\frac{1}{2}$ H. P. motor mounted on a pedestal. A large 18" diameter steel disc is fastened to each end of the motor shaft. New abrasive cloth is cemented to these discs from time to time as it wears. The rotation speed is 1400 R. P. M.

After removal of lathe tool marks with the disc grinder, the cone is given a finer finish by hand lapping with progressively finer abrasive cloth Nos. 240, 200 and 400 fastened to a wooden lapping stick approximately 6" long x $\frac{1}{2}$" wide x 3/16" thick and then buffing with a fine wire buff.

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EQUITMENT USED IN PREPARATION OF DIE BLANKS

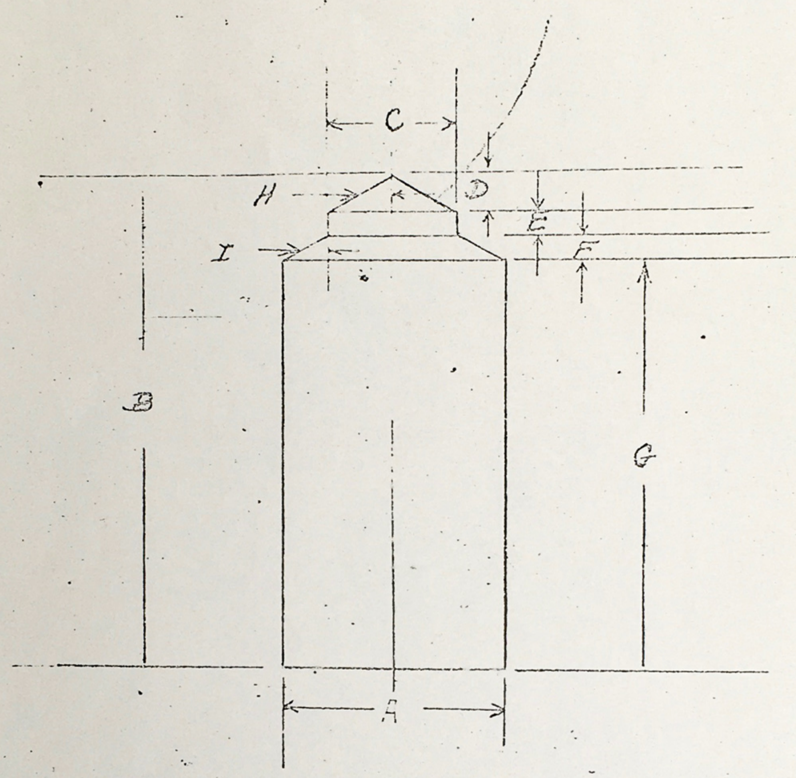
QUAN.	NAME	SIZE	AREA CONSUMED	REMARKS
1	TURRET LATHE	21' x 5'-6"	115 sq ft	USED FOR #1 BLANK & FOR BLISS PRESS
1	CONE AUTOMATIC MACHINE	20'-6" x 5'-6"	113 sq ft	USED FOR BLANK (1A)(5)(10)(25)(50)
1	ENGINE LATHE	8' x 4'	32 sq ft	USED FOR LEVEL CUTTING OF BLANK
1	GRINDER (DISC)	5' x 2'	10 sq ft	GRINDING CONE PART OF BLANK
		TOTAL AREA.	270 sq ft.	

NOTE:

① One Man is used in this operation. See the following page for blank details.

② Bar Stock Rack for Cone automatic machine 11' long.

DIE BLANK DETAIL



SINGLE AND DUAL COINAGE BLANKS									
DENOMINATION	A	B	C	D	E	F	G	H	I
1¢ 5¢ AND 10¢ SINGLE OBV REV	1.480	2 11/16	.937	1/8	1/8	1/8"	2 5/16	20°	20°
1¢ 5¢ AND 10¢ DUAL OBV REV	1.480	2 7/8	.937	1/8	1/8	1/8	2 1/2"	20°	20°
25¢ SINGLE OBV. & REV	1.480	2 11/16	1.125	9/32	1/8"	1/8"	2 5/32	20°	20°
25¢ SINGLE PROOF REVERSE	1.480	2 7/8	1.125	5/16	1/8	1/8	2 5/16	30°	30°
50¢ SINGLE OBV & REV.	1.605	2 13/16	1.240	3/16	1/8	1/8	2 3/4	25°	25°

HOBBING OPERATION.

The finished coned blank is then ready for hobbing. This is accomplished by placing the blank and the hardened hub in a special fixture or subpress so that the inverted hub (face) is in alignment with the center of the cone on the upright blank. The fixture is adjustable so that different diameter blanks and hubs can be made to register center over center. The fixture with blank and hub is then centered on the anvils of a hydraulic press (capacity 700 tons) and pressure is applied, approximately 50 tons for 10¢, 60 tons for 1¢ and 5¢, 70 tons for 25¢ and 90 tons for 50¢. This forces the face of the hub against the co... on the annealed blank causing it to take a negative impression from the positive design on the hub.

One Hydraulic press (Watson Stillman) 700 ton capacity.
One " " " " 800 ton "

Old Press Size is 5' x 8' = Area = 40 sq ft
New Press Size is 7'-6" x 6' = Area = 45 sq ft
Total Area = 95 sq ft

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ANNEALING OPERATION

The blank has now become work hardened and resists further movement. To relieve this condition the blank is annealed by packing in hardwood charcoal in nichrome cups and heating in an annealing furnace to 1425° F. soaking at this temperature for 4¼ to 4½ hours and then allowing to cool very slowly in the shutdown furnace, generally, overnight. The annealed die is now carefully cleaned with a dilute solution of Hydrochloric Acid (1 part acid to 3 parts water), hot water and thoroughly scrubbed with pumice soap. The hub is now carefully registered into the existing impression on the die and placed in the hydraulic press for a second blow (squeeze) using the same pressures as before. This procedure is repeated a third time for all U. S. coins except the half dollar which sometimes requires a fourth blow.

The die impression is now carefully examined to make sure complete, all over contact has been made with the design on the hub, that there are no doubles (failure to exactly register) and that it is clean with no foreign inclusions or impressions, scratches, etc.

	SIZE	AREA CONSUMED/FURNACE
Two Annealing Furnaces	10' x 6'-6"	65 sq ft.

TURNING OPERATION

The die is now fastened by the extreme lower end (base) in a 4 jaw chuck on an engine lathe and very carefully centered so that the inner edge of the border of the design runs true to center and the flat on the border runs 90° true to the axis. This is done by eye using magnification and a small pointer, accuracy to within .0001". After centering, the excess steel is turned off and the die is finished according to dimensions shown on submitted drawings in separate folder.

After turning the body of the die, it is placed in a 3 jaw chuck on an engine lathe with the base in position for cutting off to the specified length using gauges.

After turning, a different number is assigned to each die and this is stamped directly on the shoulder of the soft die and a record is kept of these numbers.

Dies prepared for single press operation are now ready for hardening. Dies being prepared for Phila. Mint dual operation are placed in a fixture on a milling machine and an accurate flat is milled into the base.

Dual dies for Denver are ready for hardening after turning to specified dimensions.

The small 'D' Mint mark is stamped, separately by hand, in the proper location on either the Obverse or Reverse of all U. S. coinage dies intended for the Denver Mint just prior to hardening.

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EQUIPMENT USED IN TURNING OPERATION

NAME	QUAN.	SIZE	AREA CONSUMED
LATHES.	11	8' x 4'	32 sq ft / lathe
MILLING MACHINE	1	7' x 6'-6"	45.5 sq ft
(SURFACE) GRINDER	1	4'-9" x 8'	38 sq ft
"	1	5' x 5'-7"	28 sq ft
"	1	5' x 7'-6"	37.5 sq ft
"	1	5' x 7'	35 sq ft
		TOTAL AREA	216 sq ft.

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HARDENING OPERATION

The dies are hardened by again packing in hardwood charcoal in individual nichrome cups and placing in a hardening furnace. The temperature is brought up to 1475° and the dies are allowed to soak at this temperature about one hour per inch of die diameter.

The dies are then removed from the cups with tongs and placed face down in the correct hole in the quenching fixture. This consists of a large tank containing a pipe system and a nozzle 1½" diameter pointing upward. This nozzle is oriented directly under a hole in the lid on the tank. Around this hole on the underside is a cylindrical baffle approximately 1½" deep x 3" in diameter to concentrate the water stream around the face and neck of the inverted die. An automatic device for mixing hot and cold water to a predetermined temperature and a quick opening valve are external parts of this quenching device.

At the instant the red hot die is inserted face down in the proper opening, the valve is opened manually and water preheated, from 70° to 76° F., under pressure, about 40 lbs. per square inch, is forced against the face of the die through the nozzle. To check the excess water from spraying around the clearance in the opening, an asbestos pad is held over the tongs and the base of the die. The die is held in this stream of water until it is cool enough to hold.

The dies are then cleaned on the face by scrubbing with a dilute solution of Hydrochloric Acid (1 part acid to 3 parts water) and pumice soap. The dies are then placed in a tempering furnace (Leeds & Northrup Homo) and kept at a constant temperature of 350° F. for 4½ hours except for 1¢ dies which are kept at 400° for 4½ hours.

They are then removed and tested for hardness and uniformity on a Rockwell Model 'TT' hardness tester, "C" Scale. Proper hardness has been established at between 59 and 61+ Rockwell "C".

Single dies for Phila. and dual dies for Denver are given a final close inspection for nicks, dents, pits, scale etc. and are then ready for setting in the coin presses or for shipment to Denver.

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EQUIPMENT USED IN HARDENING OPERATION

FURNACE	TYPE	QUAN	SIZE	AREA CONSUMED
HEVI-DUTY	GAS FIRED	1	7'x8'	56 sq ft
SURFACE COMB.	GAS FIRED CHARCOAL	2	6'x7'-6"	90 sq ft
LEEDS & NORTH.	ELECTRIC FURNACE	1	6'-8"x8' lg	53 sq ft
TEMPERING FURNACE	GAS.	2	3' DIA.	14 sq ft
QUENCHING TANKS		2	3'-6" dia	

CONTROLS FOR FURNACES

	SIZE	AREA
CONTROLS FOR HEVI-DUTY FURNACE	4'-6"x6'	27 sq ft
" " TEMPERING FURNACE	2'x6'	12 sq ft
" PANEL	6'-3x3'	18.75 sq ft

MINIMUM REQUIREMENTS AND EQUIPMENT NECESSARY TO PRODUCE COIN DIES

Employees Required		Work Processes	Equipment
Artist-Engraver	1.	To prepare drawing of completed and finished design for medal or coin.	
"	2.	Scaled pattern prepared in wax or plaster (obv. & rev.) and ratio is formulated to size of coin or medal desired.	Plaster of paris.
"	3.	Plaster negative prepared from this pattern. Letters are cut or incized in this negative side.	
"	4.	Plaster positive prepared from this negative and retouched.	
Transfer-Engraver	5.	Negative plaster then prepared to be used in forming positive galvano.	
"	6.	This negative is bees waxed and copper-coated and is dropped into copper-plating tank from extended bars.	Bees wax, galvano tank, copper-plating solution - $2000.00
"	7.	After four (4) days copper-coated galvano is taken out of tank. Galvano is trimmed.	Bridgeport Milling Mach. - $4400.00 Band-Saw - $1500.00
"	8.	Galvano is backed-up and fitted on Janvier Machine plate.	Janvier Reducing Mach. - $12,000.00

Employees Required		Work Processes	Equipment
Transfer-Engraver	9.	Hub reduction produced or cut from pattern directly in steel.	Janvier Reducing Mach.
Die Maker	10.	Hub turned and hardened. Keys or lugs are slotted in this hub (for coinage) to prepare for dies.	Surface Combustion Heating Furnace - $9000.00 2000.00 $11000.00
Machine Operator	11.	Turret lathe prepares number of die coned blanks.	Turret lathe - $25,000.00 Conomatic - $51,000.00
"	12.	Finish cone base blank on Buck Chuck Engine Lathe.	Buck Chuck Engine Lathe 10" - Monarch $13,000.00
"	13.	Coned blank die finished or polished on disc-grinder.	18" pedestal disc-grinder - $1500.00
Die Maker	14.	Hub entered over die blank in fixture on hydraulic press.	Farrell type hydraulic press, 400-600 tons - $17,000.00
Heat Treater	15.	Die struck first blow placed in annealing.	Annealing Furnace - $10,000.00 Nichrome cups & pots - $800.00 + Charcoal mesh #1 & #2
"	16.	Die struck second blow.	
"	17.	Die turned on single four-jaw chuck, or by 1st & 2nd operation using Carboloid tips fitted in Aloris tool posts or by tracer lathes.	Monarch Tool-Maker Engine Lathe 10" - $13,000.00 Tracer Lathe - $13,000.00
"	18.	Die hardened and quenched.	Surface Combustion Furnace - Water-Quenching Tank $4000.00

Employees Required	Work Processes	Equipment
Heat Treater	19. Die tempered to draw steel (water 70° to 75° F - 60 lb. pressure).	Homo-Tempering Furnace - $7000.00
Die Maker	20. Die ground to exact size.	Landis Universal Cylinder Tool Grinder - $14,000.00 Surface Grinder - $8000.00
"	21. Die fitted in die set for coining press.	

SUPPLEMENTAL ISSUE TO OPERATIONAL MANUAL

Philadelphia, Pennsylvania
August 14, 1968

A recent Die Shop innovation permits a more controlled second strike or "blow" to the "blank" at re-entry of hub.

Six milled or ground spline grooves are formed at a 45° angle on the hub. After the first "blow" the formed "lugs" on the die blank are utilized as "locators" for an additional "blow".

These spline grooves are also ground in the lathe "drivers" to machine the various size die blanks required for the dual die system of operation.

Tracer controlled Engine Lathes with templates engineered to blueprint specifications are a valuable contribution to increased volume production of dies.

An operational sequence is as follows:

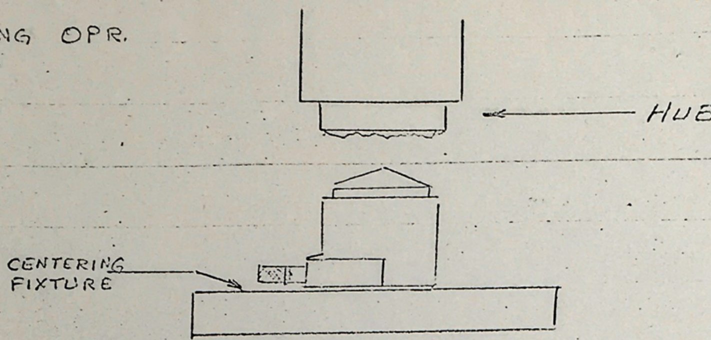
1. The polished die blank is struck by the hub at a given tonnage. The hub has a series of six spline grooves ground at a 45° angle to its face. This enables the re-entry of the hub for the final strike and also for being driven by the driver in the lathe.

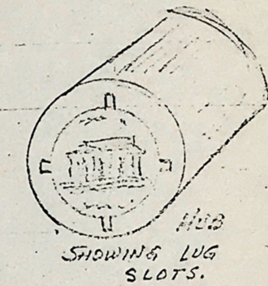
2. A driver with the desired lug slots is placed in the spindle of the lathe. The struck die blank is placed against the driver and the tailstock center is placed against the bottom of the die which has a center hole. The die is turned to a specified diameter. This is for construction purposes. This diameter is then placed in a collet. The machine (if it is a tracer lathe) is set with a template and the profiling operation begins.

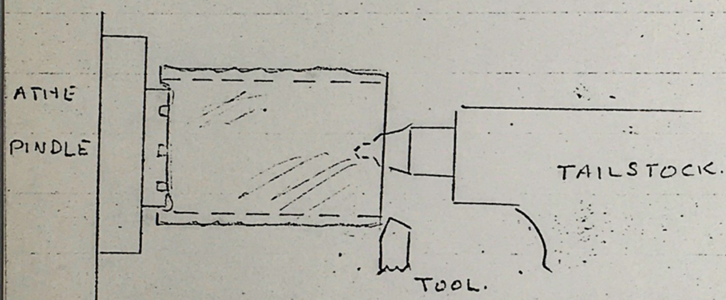
3. The turned die is then removed and placed in another lathe for cutting off the excess length to the desired size.

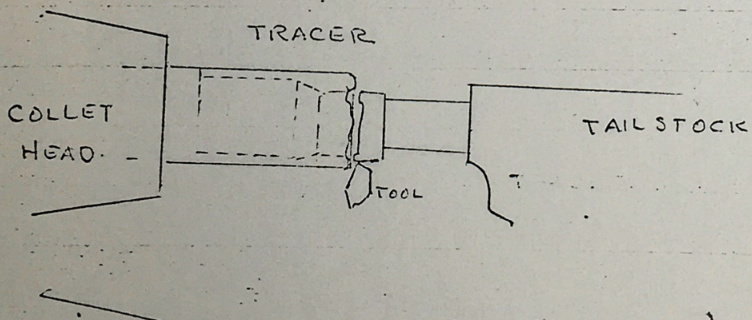
An engine lathe compound utilizes the CXA Aloris Tool Post with tri-edge carboloy tips. (Aloris Tool Co., Inc., Clifton, New Jersey.)

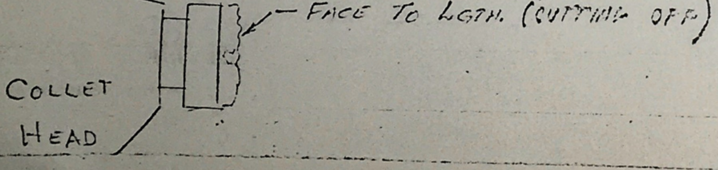
1ST STRIKING OPR.











A. B. Macellaro ABM April 4, 1966

Analysis of Present Die Production
Capacity and Requirements for F.Y. 67

The detail data presented in this report was accumulated from the following sources:

(a.) Estimated coin production for the remaining fiscal year 66 and fiscal year 67, from Mr. S. Carwile.

(b.) Average coining die life, from reports sent to Bureau and discussions with Mr. D. Young.

(c.) Die production details, from Mr. F. Gasparro.

A. Accumulated Data:

1. Coining die production for F. Y. 66.

(a.) The estimated coin production for the remaining months of F.Y. 66, from March through June, inclusive, is 3,303,000.000 coins.

(b.) Dies required for estimated production, per denominations are as follows:

One Cent	- 1,328	dies
Five Cent	- 700	"
Dime Clad	- 20,181	"
Quarter Dollar (Clad)	- 12,868	"
Half Dollar (Silver)	- 5,618	"
Half Dollar (Silver Clad)	- 596	"
Approximate total of dies required	- 41,291	"

For estimated die production. See Data Sheet #1.

201400
13
301400

2. Coining die production for F.Y. 67.

(a.) Estimated coin production is 13,008,000,000.

(b.) Dies required for estimated production per denominations are as follows:

One Cent	-	4,216 dies
Five Cent	-	4,332 "
Dime (Clad)	-	70,588 "
Quarter Dollard (Clad)	-	21,669 "
Half Dollar (Clad)	-	6,084 "
Approximate total dies required	-	106,889 "

For estimated die production. See Data sheet #2.

3. Coining die production for Special Mint Sets (F.Y.66).

(a.) Estimated Mint Set production 4,000,000.

(b.) Dies required for estimated production per denominations are as follows:

One Cent	-	160 dies
Five Cent	-	228 "
Dime (Clad)	-	532 "
Quarter Dollar (Clad)	-	532 "
Half Dollar (Clad)	-	132 "
Approximate total dies required	-	1,584 "

For estimated die production. See Data sheet #3.

4. Coining die production for Special Mint Sets (F.Y. 67).

(a.) Estimated Mint Set production 8,000,000.

(b.) Dies required for estimated production per denomination are as follows:

One Cent	-	320 dies
Five Cent	-	456 "
Dime (Clad)	-	1,064 "
Quarter Dollar (Clad)	-	1,064 "
Half Dollar (Clad)	-	264 "
Approximate total dies required	-	3,168 "

For estimated die production. See Data sheet #3.

5. Available equipment and manpower in engraving department (Die Shop).

1. Seventy-five men. Twenty-five/shift.

2. Equipment

   (a.) 18 conventional lathes

   (b.) 3 cylindrical grinders

   (c.) 2 surface grinders

   (d.) 7 hardening furnaces

   (e.) 4 annealing furnaces

   (f.) 1 conomatic lathe

   (g.) 1 turret lathe

   (h.) 2 hubbing presses

6. The maximum utilization of available equipment and capacity based on a production rate of 2,116 dies/wk. (1965)

The following results are based on a time study submitted by Mr. Gasparro. See sheet #4.

Operations	Die Prod. Rate/21 hr.	Die Prod./week
Conomatic	600	3,000
Disc Grind #1	600	3,000
Disc Grind #2	600	3,000
Hubbing #1	630	3,150
Annealing	600	3,000
Hubbing #2	600	3,000
Turning - 7 Lathes	441	2,205
Machining Base - 3 Lathes	756 duals	3,780
Inspection and Cleaning (2 men)	504	2,520
Die Hardening (7) Furnaces 25 Dies/furnace 175 Dies/3 hours (2 shifts) Quenching	700	3,500
Tempering (1) shift (4) Furnaces	560	2,800
Grinding Duals and Singles	252	1,260

7. Manpower required to produce 2,116 dies per week.

Operations		Total Manpower/3 shifts
1.	Conomatic	1
2.	Disc Grinding #1	1
3.	Disc Grinding #2	1
4.	Hubbing #1	6
5.	Annealing	6
6.	Hubbing #2	6
7.	Turning Lathes	21
8.	Base Machining	9
9.	Inspection and Cleaning	6
10.	Die Hardening	4 (2 shifts)
11.	Quenching	4 (2 shifts)
12.	Tempering	2 (1 shift)
13.	Grinding (Philadelphia only)	6
	Total	73 men

In view of the above results no additional manpower is required.

8. Estimated production increase, by DeVlieg method:

Method Operations	Estimated Time in Minutes
Center Drilling	1
Rough Turning	1½
Finish Turning	2½
Total time	5 minutes

In view of the above results, the DeVlieg operation will produce one die every 5 minutes.

Estimated die turning production for a 7 hour production/shift.

Operation	Dies/hr.	Dies/shift	Dies/3 shift	80% efficient Dies/week
Center Drilling	60	420	1,260	5,040
Rough Turning	40	280	840	3,840
Finish Turning	24	168	504	2,016

Based on the above results no additional equipment is needed with the exception of another turning lathe.

DIE PRODUCTION FOR F.Y. 66

DENOMINATIONS	PRODUCTION ESTIMATE FOR MARCH & JUNE	AVERAGE LIFE OF OBVERSE DIES. (STRIKES)	AVERAGE OBVERSE LIFE	AVERAGE LIFE OF REVERSE DIES (STRIKES)	AVERAGE REVERSE LIFE	AVERAGE LIFE OF REVERSE & OBVERSE DIES	TOTAL DIES REQUIRED
1¢	756×10^6	1,007,653 (P) 1,330,000 (D)	$1,168 \times 10^3$	1,044,207 (P) 1,173,752 (D)	1108×10^3	1,138,000 ✓	1328
5¢	97×10^6	319,000 (P) 216,000 (D)	267,000	324 000 (P) 251,000 (D)	287,540	277,000 ✓	700
CLAD 10¢	1.904×10^6	191,476 (P)	181,476	181,563 (P)	181,563	? 187,000 ✓	20,181
CLAD 25¢	978×10^6	178,000 (P) 134,144 (D)	156,072	176 000 (P) 121,000 (D)	148,500	152,286 ✓	12,868
CLAD 50¢	53×10^6	13 192,000 (D)	192,200	 162,000 (D)	162,800	177,500 ✓	596
SILVER 50¢	15×10^6	626 361 ~~62,656~~ (P) 339 344 ~~50,340~~ (D)	~~56,500~~	470,043 ~~47,043~~ (P) 473 834 ~~53,536~~ (D)	50,289 ✓	~~53,394~~ ✓	~~[illegible]~~

APROX. TOTAL DIES 35,673

DIE PRODUCTION FOR F.Y. 67

DENOMINATIONS	COIN PRODUCTION ESTIMATE F.Y. 67	AVERAGE LIFE OF OBVERSE & REVERSE DIES (STRIKES)	TOTAL NO OF DIES REQ'D
1¢	2400×10^6	1,138,000	4,216
5¢	700×10^6	277,000	5054
10¢	6600×10^6	187,000	70,588
25¢	3300×10^6	152,286	21,669
50¢	108×10^6	177,500	6084
		APPROX. TOTAL DIES	107,611

SHEET #2

SPECIAL MINT SET, DIE PRODUCTION F.Y. 66 & 67

DENOMINATIONS	PRODUCTION ESTIMATE FOR F.Y 66 MAR. TO JUNE	PRODUCTION ESTIMATE FOR F.Y 67	AVERAGE LIFE OF OBVERSE & REVERSE	TOTAL NO OF DIES REQ'D F.Y. 66	TOTAL NO OF DIES REQ'D F.Y. 67
1¢	4,000,000	8,000,000	50,000 STRIKES	160	320
5¢	"	"	35,000	228	456
10¢	"	"	15,000	532	1064
25¢	"	"	15,000	532	1064
50¢	"	"	60,000	132	264
			APPROX. TOTAL DIES	1584	3168

SHEET # 3

PRESENT DIE OPERATIONAL DATA

TIME STUDY.

OPERATIONS REQUIRED IN MANUFACTURING OF DIES	No. OF PIECES PRODUCED 24 HRS.	OPERATIONAL TIME IN (MINUTES) FOR SINGLE DIES		OPERATIONAL TIME IN MINUTES FOR DUAL DIES		
		25¢	50¢	1¢	5¢	10¢
CONOMATIC CUT BLANKS	600	–	–	–	–	–
CLEANING.	600	–	–	–	–	–
GRINDING #1 CONE OF BLANK	600	2½	→	→	→	→
GRINDING #2 CONE OF BLANK	600	2½	→	→	→	→
HUBBING (FIRST BLOW)	270	4	→	→	→	→
ANNEALING (AVERAGE)	270	3	→	→	→	→
HUBBING. (SECOND BLOW)	270	4	→	→	→	→
TURNING. OPER. (BODY)	270	15	15	17	→	→
MACHINING BASE OF DIE	270	5	→	→	→	→
INSPECTION & CLEANING.	270	5	→	→	→	→
HARDEN DIES (HEATING)	270	5	→	→	→	→
QUENCHING	270	4	→	→	→	→
TEMPERING	270	3.	→	→	→	→
GRINDING FLATS DUALS.	45 DUALS	–	–	8 :10	→	→
GRINDING BODY (DUALS)	45 DUALS	–	–	9 15	→	→
FINAL INSPECTION	270	5	→	→	→	→
TOTAL TIME REQ'D TO PRODUCE ONE DIE		56 MIN	56 MIN	76 MIN	76 MIN	76 MI